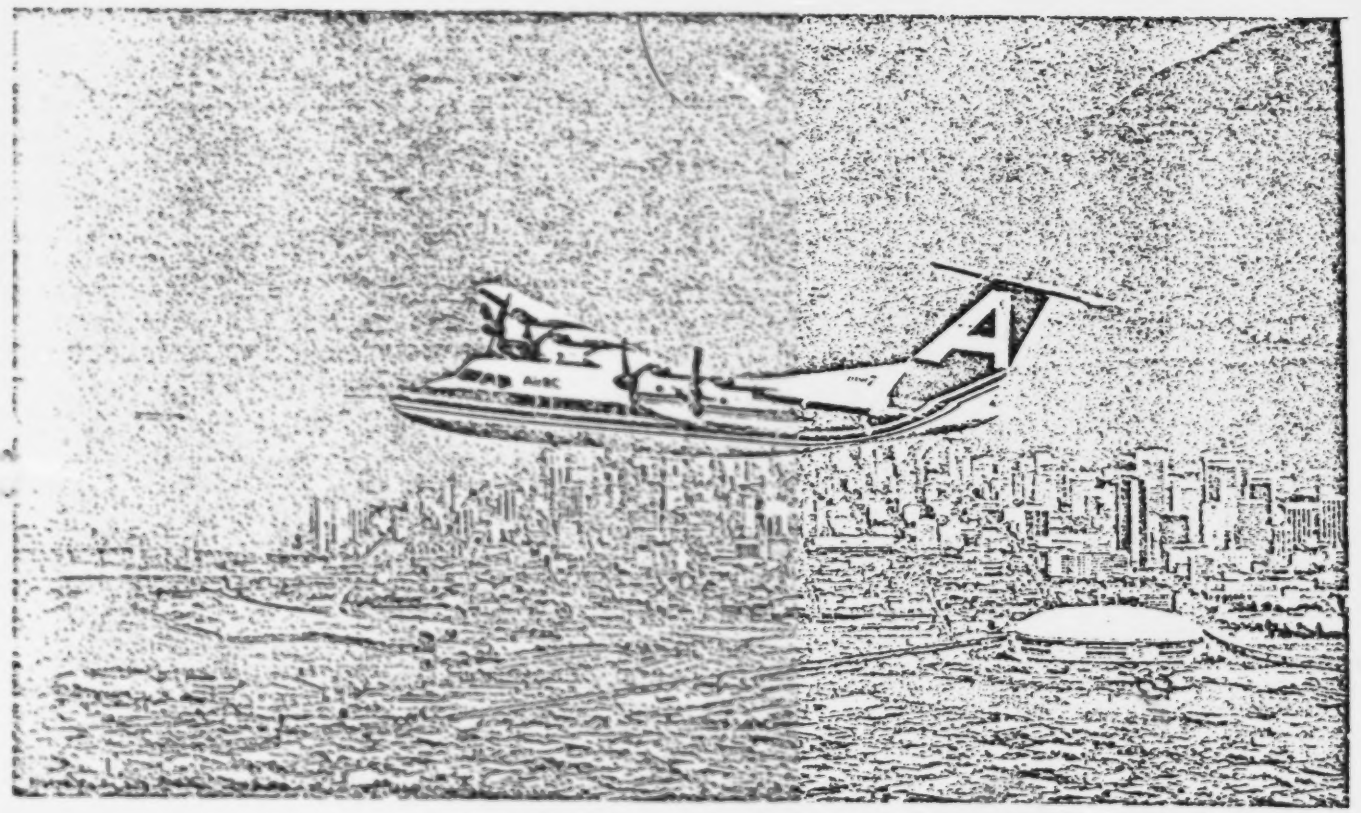
TP5686E

COST BENEFIT ANALYSIS OF MICROWAVE LANDING SYSTEM FOR STOL AIRCRAFT SERVICE AT PEMBERTON AIRPORT



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Prepared for
Transport Canada
Transportation Development Centre

by

AirBC

September, 1984

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The contents of this report reflect the views of the contractor and not necessarily the official views or policies of the Transportation Development Centre.

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17. Abstract

This study evaluates the costs and economic benefits of developing Pemberton Airport, serving the Whistler resort area in British Columbia. It assesses the technical feasibility and costs of installing a microwave landing system to permit all-weather STOL (short take-off and landing) air service. Current and potential air traffic and alternative transportation development options are examined and the net benefits derivable from airport development are estimated. The study concludes that these benefits justify the $3.8 million capital costs.

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17. Résumé

Ce document rend compte de l'étude sur le rapport avantages-coût et la faisabilité technique du système d'atterrissage hyperfréquence envisagé pour l'aéroport de Pemberton en Colombie-Britannique. Ce système permettrait la mise en place d'un service ADAC tous temps à cet aéroport qui dessert aussi la région de Whistler, un centre de villégiature. Se fondant sur le trafic aérien actuel et prévu en tenant compte des divers systèmes de transport existants et envisageables, il établit les profits nets pouvant découler d'une telle modernisation. Le rapport conclut que les profits réalisables justifient la dépense d'investissement de 3.8 millions de dollars.

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Coûts. Avantages. Techniques Economiques. Faisabilité. Système d'atterrissage hyperfréquence. Adac. Pemberton	Le CDT dispose d'un nombre limité d'exemplaires.

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EXECUTIVE SUMMARY

OBJECTIVE

This brief presents a joint industry-municipal government solution towards solving the problem of providing reliable access to the Whistler resort area. Improved access will assist in the Whistler area becoming a year-round, world-class destination resort. The proposed air service to Whistler/ Pemberton, in addition to assisting in the further utilization of Whistler resort facilities, will also provide a practical demonstration of the capabilities of Canadian technology to meet a challenging transportation problem. These capabilities can be shown to the thousands of visitors who will come to Expo '86.

PROJECT SPONSORS

The joint sponsors of the proposed air service project represent both the air industry and municipal government who have combined their respective talents to offer a solution to the Whistler transportation access problem. The sponsors are the following:

- Village of Pemberton
- Resort Municipality of Whistler
- AirBC
- The de Havilland Aircraft of Canada Limited
- Micronav Ltd.

The project has been conceived over a period of time and has involved a number of discussions with government and civic officials, other airlines, technical manufacturers and other interested parties in order to properly assess the air service market, technical feasibility and costs of an aircraft precision landing approach in mountainous terrain and the economic justification and benefits of a technically advanced STOL air service.

MARKET ANALYSIS

Over the past few years, some $350 million has been invested in the Whistler area and it is estimated that over the next ten years there will be another $250 million invested in order for it to become a year-round, world-class resort.

There are currently some 73,000 overnight visitors each year to Whistler, of which nearly two-thirds are winter ski visitors. Overnight visitors now account for about 21 percent of the total visitors and it is expected that this percentage will reach 30 percent by 1988/89. The Whistler Resort Association expects that overnight visitors will grow at 15 percent, compounded each year, as new facilities and services are introduced.

Surveys show that 57 percent of the overnight visitors in the winter and 30 percent of those in the summer were non-British Columbia residents and could be considered a potential air travel market. A further examination of the market potential segregated those visitors who likely would travel by air to Vancouver and/or Seattle and who would likely interline to a direct air service to Whistler if such a service were available.

Based on the experience of Rocky Mountain Airways, a Colorado based airline, operating a similar technically advanced air service to resort areas and the proposed use of all-inclusive tour packages and through fares to stimulate air travel, projections were developed for a Vancouver and a Seattle Gateway direct Whistler/Pemberton air service. Projections were also developed for a Vancouver gateway only service.

The market analysis indicates that an air service, serving both Vancouver and Seattle with a direct service to Whistler/Pemberton, would generate nearly 19,000 one-way passengers. This figure could double within a five year period with a reliable year-round air service, joint fares, and aggressive marketing. The Vancouver gateway only air service, which would exclude most local Northwest U.S. boardings is expected to generate 14,000 one-way passengers. Again, this figure is expected to double within a five year period.

TECHNICAL ANALYSIS

The Pemberton Airport, located 32 km northeast of Whistler, is the best location for an airport in an area with extremely mountainous terrain. The Pemberton Airport has recently been constructed with the assistance of grants from the Federal and Provincial Governments. At the present time, however, there are no navigational approach aids nor lighting at the airport. Without these navigational and lighting facilities, air service is restricted to daylight operations in visual meteorological conditions. Given the mountainous terrain and prevailing weather patterns, a very high percentage of scheduled flights would be subject to cancellation due to weather even in daylight hours.

Reliable air service is required if the Whistler resort area is to become a year-round destination resort. It would be totally unacceptable to have an air service which was often cancelled due to unsuitable weather conditions. The de Havilland Aircraft Company of Canada Limited conducted a survey with a view to recommending what electronic aircraft landing aids could be used to achieve the required reliability. A precision instrument approach is possible with the use of a technically advanced microwave landing system in conjunction with non-directional beacons and high-intensity airport approach lighting. The landing system also assumes the use of the de Havilland Dash 7 STOL aircraft with its steep approach path and maneuverability.

Two air service patterns are being considered. The preferred alternative, which best meets the needs of the travelling public is a route pattern which uses both Vancouver and Seattle as gateways for direct air service to Whistler/Pemberton. In the winter, three flights a day from Vancouver would be offered and two flights a day from Seattle. The summer season would have one flight daily from Vancouver. The second air service is a Vancouver gateway only service. This service would schedule four flights a day in the winter and one in the summer.

ALTERNATIVE GROUND TRANSPORTATION

Ground transportation to Whistler has not been reliable and presents a serious problem which is expensive to solve. Both the rail line and the highway have been subject to frequent closures due to washouts and other hazards, particularly in the Horseshoe Bay-Squamish section of the route.

A decision has been reached by the Ministry of Transportation and Highways to upgrade the existing highway route at a cost of $140 million. The construction cost in the Horseshoe Bay-Britannia section are $6 million a mile, compared to $1 million for the Cheakamus Canyon section. In 1982, some $7.4 million was expended in capital improvements to the highway and $3.2 million in maintenance.

The planned expenditures for highway improvements will mainly benefit the day visitor to Whistler. The day visitor, however, makes expenditures of less than half of those of the overnight visitor. It is the overnight visitor who is the prime market for the proposed air service. Capital expenditures on air transport facilities, therefore, will provide relatively more benefits to the Whistler resort economy.

PROJECT BENEFITS

The proposed air service to the Whistler/Pemberton area will provide very significant benefits to the local economy, the Province of British Columbia and Canada. The attached summarizes the major benefits of the air service project which justifies the $3.8 million estimated capital cost to provide the necessary precision navigational approach aids, airport lighting and air terminal building facilities.

Project Benefits Summary

Operating Benefits - Annual

Pemberton

10 man years of direct employment @ $233,000 in wages and salaries
18 man years of indirect employment @ $374,000 in wages and salaries
value of airport equipment and supplies $64,750
value of bus materials and supplies $15,000

Tax and other Revenues	Village	Federal	Provincial
- direct employment income tax		27,200	12,800
- sales tax			1,050
- fuel tax		2,500	4,000
- corporate income tax		3,027	1,816
- air passenger boarding fee	31,253		
- bus concession fee	15,626		
- aircraft landing fee	25,090		
- air terminal fees	6,100		
- terminal concession fees	2,000		
- ground aviation concession fees	12,800		
	92,869	32,727	19,666

Whistler

135 man years of direct employment attributable to air visitors with $3.2 million in wages and salaries
327 man years of indirect employment @ $8.7 million in wages and salaries
value of direct expenditures by air visitors $6.9 million
value of indirect expenditures as a result of air visitors $18.6 million

Tax and other Revenues	Federal	Provincial
- direct employment income tax	629,699	296,012
- sales tax		753,485
- corporate income tax	129,169	77,501
	$758,868	$1,126,998

Project Benefits Summary (Cont'd)

AirBC
about 6 man years of additional employment
@ $140,387
value of air ticket revenue in 1986/87 $4.6 million
value of expenditures (not including fuel) $80,634

Tax and other Revenues	Other	Federal	Provincial
- air transportation tax		271,601	
- landing fees	32,890	17,290	
- aviation fuel tax		41,411	65,352
- direct employment income tax		16,425	7,721
- sales tax			5,644
- corporate income tax		274,072	164,443
	$32,890	$620,799	$243,160

Total Project Benefits (Annual)	Other	Federal	Provincial
Pemberton	92,869	32,727	19,666
Whistler	-	758,868	1,126,998
AirBC	32,890	620,799	243,160
	125,759	1,412,394	1,389,824

- Nearly $3 million in benefits generated each year.

Other Benefits

- Instrument Approach Benefits
- International Balance of Payments
- Value of Time Benefits
- Whistler Resort Area Benefits
- Expo '86 Benefits

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Appendix

1.0 OBJECTIVE

The purpose of this brief is to present a joint industry-municipal government solution towards solving the problem of providing reliable access to the Whistler resort area. Improvement of the access will assist in the Whistler area achieving its goal of being a year-round, world-class destination resort. In addition to assisting in the further utilization of Whistler resort facilities, the project also will provide a practical demonstration of the capabilities of Canadian technology to meet a challenging transportation problem. These capabilities can be shown to the thousands of visitors who will come to the Vancouver area for Expo '86, the World Transportation and Communications Exposition.

2.0 PROJECT SPONSORS

The joint sponsors of the project represent both the air industry and municipal government. They have combined their respective talents to offer a solution to the Whistler transportation access problem. The following introduces the project sponsors:

- Village of Pemberton - The Village is the location of the Pemberton Airport now being developed by the Village, Government of British Columbia and Government of Canada. The airport is some 32 km northeast of Whistler.

- Resort Municipality of Whistler - The site of the Whistler Resort area, which is being developed by the Government of British Columbia and the Government of Canada under the Travel Industry Development Subsidy Agreement (TIDSA), Whistler Land Development Co. Ltd. (a British Columbia Crown Corporation), private investors and the Municipality.

- AirBC - AirBC is a Vancouver based airline which operates an extensive air route network in British Columbia and which has applied to the Canadian Transport Commission for a license to operate scheduled air service into the Pemberton Airport.

- The de Havilland Aircraft of Canada Limited - This aircraft manufacturer is located in Toronto, Ontario and is a Canadian Crown Corporation. It manufacturers advanced STOL-type aircraft which are known throughout the world for their unique short takeoff and landing capabilities. The Dash 7 (DHC-7) is a four-engine, turbo-prop aircraft, manufacturered by de Havilland and in wide use. AirBC owns three of these 50-seat aircraft.

- Micronav Ltd. - This is a manufacturer of electronic navigation equipment which is based in Sydney, Nova Scotia. The Company manufactures a microwave landing system (MLS) which is an aeronautical precision approach aid which the International

Civil Aviation Organization (ICAO) have adopted as the world standard navigation aid to replace conventional Instrument Landing Systems (ILS) by 1995. Micronav, in conjunction with Nautical Electronic Laboratories Ltd. (NAUTEL) of Halifax, Nova Scotia and Canadian Marconi Limited, Toronto, can provide a turn-key airport navigation system including the microwave landing system, non-directional beacons, antenna and microwave landing system receivers.

The project has been conceived over a period of time. Air transportation to meet the travel needs of visitors to Whistler has been discussed for several years. In the late 1970's however, the development of Whistler accelerated with the building of Whistler Village and the additional ski facilities of nearby Blackcomb Mountain. Over $350 million was invested in the resort area by public and private investors. The development focused attention on the problems of reliable year-round access using the Squamish Highway. In 1980 the Province of British Columbia and the Regional District conducted a study to determine the feasibility of an airport to serve the Whistler area. This study selected the Pemberton Airport as the best site for airport development. Transport Canada endorsed the findings of the study as to Pemberton Airport being the most suitable location from an aeronautical point of view.

In September of 1979 the Village of Pemberton received an Air Transport Assistance Program grant from the British Columbia Ministry of Transportation and Highways to investigate air traffic demand potential and the feasibility of improving an existing turf air strip developed by volunteers of the Pemberton Flying Club. Based on the recommendations of the 1980 study that the Pemberton Airport was the best location to serve both Whistler and Pemberton, further grants were awarded by the Province of British Columbia and the Federal Government to develop the airport. It is estimated that over $1.1 million has been invested in the existing airport facilities, including $680,000 in grants from the senior levels of Government.

Current facilities consist of a 3,500 ft. by 100 ft. compacted gravel runway, 150 ft. by 300 ft. gravel aircraft apron area and a connecting gravel taxiway. Improvements have been made to an access road, dyke protection from the nearby Lillooet River, aircraft tie-down area and a camping and picnic area on the airport property. A Development Plan has been prepared by the Village of Pemberton which outlines the development phases of the airport to meet future aviation growth over the next 20 years. The Pemberton Airport is a publicly licensed airport but is limited to day, visual meteorological conditions (VMC) use only. These airport limitations are acceptable for recreational use by light aircraft but are not suitable for scheduled air service which must operate in all weather conditions and at night. The surrounding mountainous terrain, however, precluded the use of conventional landing approach aids and airport lighting to permit air service in instrument meteorological conditions (IMC) or night operations.

AirBC, in 1983, purchased its first de Havilland Dash 7 airliner for service to many coastal points. The aircraft has proven very popular with the travelling public and two additional aircraft have been recently added to the fleet. With its STOL characteristics, this 44,000 pound aircraft is capable of operating in and out of gravel runways as short as 2,500 ft., half the length required by conventional aircraft. The unique design of the aircraft permits much steeper take-off and approach flight paths which, in turn, allows for increased maneuverability in difficult terrain. The aircraft also has a low noise exposure on the ground due to the steeper flight paths.

Initial investigation by AirBC as to the feasibility of air service pointed out the large potential market in meeting the requirements of visitors to the Whistler resort area. The mountainous terrain and the weather conditions, particularly in the peak traffic winter months would render the air service uneconomic even with the STOL characteristics of the de Havilland Dash 7. A reliable precision approach navigation system and night lighting would be needed before scheduled air service could be initiated to the Pemberton Airport.

It was brought to the attention of both the Village of Pemberton and AirBC that an American carrier, Rocky Mountain Airways of Denver, Colorado, operated a successful air service to a number of ski resorts in similar terrain to British Columbia. Visits were made by the Mayor of Pemberton and the President of AirBC to examine the Rocky Mountain Airways operation.

The visit to Rocky Mountain Airways pointed out several similarities between the Colorado air services and the proposed Whistler/Pemberton air service in British Columbia. Rocky Mountain Airways, from the Denver hub, serves three year-round destination resort areas - Aspen, Vail and Steamboat Springs. The three resort areas are similar to Whistler in terms of the recreational facilities, distance from a major city, visitor market profiles and so forth. Air service is provided by de Havilland Dash 7 aircraft and frequent service is provided (Aspen - 9 flights a day; Steamboat Springs - 6 flights a day; and, Vail - 5 flights a day). Rocky Mountain Airways was the first in the world to operate the Dash 7 and a 50% increase in traffic was recorded in 1978 when the aircraft was introduced into service to replace the de Havilland Twin Otter, a smaller 19 seat, non-pressurized aircraft.

Rocky Mountain Airways attributes its scheduled reliability in mountainous terrain as one of the major reasons for the successful development of air service to the three resort areas. Reliability has been achieved with the use of microwave landing systems, non-directional beacons and airport lighting. Rocky Mountain Airways use an MLS built by Singer in the late 1960's for tactical military requirements. This early version of the MLS called TALAR, provides only one localizer and glideslope path, unlike the multiple approach capability of present MLS; however, the TALAR as a precision approach aid in a mountainous environment has a signal reliability which is not possible with conventional ILS. The MLS also permits much steeper approaches (up to 8^{o}) in comparison to the ILS (3^{o}). Non-directional beacons (NDB) are used for track guidance in conjunction with the MLS.

The airports are also equipped with strobe approach lights, visual approach slope indicator lights (VASI) and full runway lights to assist in obtaining a visual reference to the airport runway during low visibility conditions. These navigational approach aids and lighting permits Rocky Mountain Airways to complete nearly 97% of their scheduled flights.

It was also learned from the visit to Rocky Mountain Airways the importance of inter-connection passengers and the use of joint fares and other fare packages to promote the market potential of destination resorts. Rocky Mountain Airways has been increasing its traffic by 20 - 25% each year by aggressive marketing. It connects to all the major U.S. air carriers at the Denver hub where it interlines over 80% of its passengers. It has negotiated joint fares with the major air carriers serving Denver, whereby an interline passenger can continue on from Denver to Vail for an additional $12.00 (U.S.) (full sector fare $74.00). Similarly, the add-on joint fare from Denver to Steamboat Springs is $19.00 (full sector fare $64.00) and to Aspen, $25.00 (full sector fare $64 - $81). These joint promotional fares help stimulate the air visitor market to the Colorado resort areas by providing the air traveller with a lower total fare. It also provides the air carrier with revenue it may not have earned without the promotional fare.

Based on the experience of Rocky Mountain Airways, investigations proceeded as to the availability of an MLS precision approach system. Discussions were held with de Havilland Aircraft of Canada Limited as to the technical feasibility of using a precision landing approach aid in conjunction with the STOL capabilities of the Dash 7 at Pemberton. Micronav, an established manufacturer of electronic navigation equipment, had developed a Canadian designed microwave landing system based on the ICAO standard for time reference scanning beam (TRSB) multiple localizer and glideslope approach paths and this equipment could be made available. De Havilland and Micronav have developed the technical specifications and the capital costs to install and use an MLS based precision approach system for the Pemberton Airport.

Based on the analysis of the potential market which could be served and the technical feasibility of providing scheduled service at all times and in all weather conditions at Pemberton Airport, AirBC has proceeded to submit an application to the Canadian Transport Commission to serve Pemberton Airport.

3.0 MARKET ANALYSIS

The market potential for an air service to the Pemberton/Whistler area has been assessed based on published information on the use of Whistler area facilities and visitor profile information. Discussions have also been held with the Whistler Resort Association, Whistler Land Development Company Ltd., Resort Municipality of Whistler, Whistler Chamber of Commerce, Village of Pemberton, Ministry of Tourism, Ministry of Transportation and Highways and Ministry of Industry and Small Business Development as to the market potential for air service.

Over the past few years, over $350 million has been invested in the Whistler area to transform it into a major destination resort. Some $13 million was invested by the senior government levels under the TIDSA program and the provincial government has a larger investment through its Crown Corporation, Whistler Land Development Company Ltd., which owns substantial land and facilities in the area. It is estimated that over the next ten years there will be another $250 million invested in Whistler in order for it to become a year-round world-class resort.

The investment has included the development of Blackcomb Mountain in addition to Whistler Mountain, up-grading of lift capacity and the completion of modern accommodation adjacent to the ski hills. The development now includes the following:

- ski runs on two different mountains - Whistler and Blackcomb;
- 21 high capacity lifts, including eight triple chairs and eight double chairs, two T-bars and a four-passenger gondola lift;
- the highest serviced vertical drop in North America;
- ski runs offering choices for novice and expert alike, including a bi-annual World Cup competition;
- 14 km of groomed cross-country ski trails;

- an attractive, pedestrian-oriented village, offering over 660 units (2,800 beds) of accommodation and complete with a wide variety of shopping, restaurants and entertainment;
- additional accommodation in the immediate Whistler Valley area raising the total accommodation to 924 units (3,700 beds);
- 18-hole, Arnold Palmer designed golf course (12,000 rounds in its first year and 20,000 projected for 1984);
- construction of a 77,000 square foot convention centre which will accommodate 2,000 people. It will have full kitchen facilities to serve 500 meals, eight meeting rooms and a 300 seat theatre. This centre will be open in May 1985;
- development of recreation facilities, including indoor racquet sports, gymnasium, water slide (enclosed tubes for year-round use), a major tennis centre with four indoor and four outdoor courts;
- four additional accommodation projects with 200 rooms to be completed, one development of 50 rooms to be finished in 1984. An additional 160 rooms to the Delta Mountain Inn Hotel are planned as well;
- one, or both, mountains will operate facilities in the summer months for visitors;
- a credit union banking facility (North Shore Credit Union) to provide the first bank in Whistler on June 1, 1984; and
- upgrading the gondola lift on Whistler Mountain and additional facilities on Blackcomb Mountain.

In addition to the above facilities, the Whistler area is endowed with fresh water lakes and mountains that offer a wide range of outdoor activities including hiking, mountain climbing, boating, windsurfing and trail riding.

The good skiing conditions and the range of ski facilities generated some 730,000 skier days of utilization. The Whistler Mountain facilities accommodated 60% of the total skiers while Blackcomb the remaining 40%. The number of total skier days is expected to grow at 8% each year to generate 1,051,000 skier days by the winter of 1989/90. Those skiers who used overnight accommodation now account for about 22.6% of the total skier days but are expected to increase from 165,000 skier days in 1983/84 to 330,000 skier days in 1989/90 or 31.1% of the total market. The projected growth rate is 15% per year for the six year forecast period.

The total summer visitors are not recorded, but overnight visitors for the summer of 1983 were 53,751. or about a third of the winter visitor nights. Based on the active market campaign of the Whistler Resort Association and the substantial number of new facilities which can be used in the summer, it is expected that summer visitor growth rates will increase significantly over the next few years.

For the purpose of determining the present market for air service, only those visitors to the Whistler resort area who use overnight accommodation have been included. Day visitors will have a tendency to drive to Whistler rather than take advantage of air transportation. The Whistler Resort Association conducted recent surveys of visitors using Whistler accommodation for the 1982/83 winter season and the 1983 summer season. The surveys included information on the number of overnight visitors, place or origin, length of stay and expenditures on accommodation.

The surveys show that during the winter some 46,631 visitors used overnight accommodation, of which 57% were non-British Columbia residents. During the summer, some 26,348 visitors used overnight accommodation but only 30% were non-British Columbia residents.

Table 1, overleaf, presents a base year estimate of one-way air travel by major origin markets. The table assumes that the prime air market for the Whistler resort area will be those visitors who will interline from other air carriers at Vancouver and/or Seattle to the AirBC air service to Whistler/Pemberton.

The base year market estimate was used to determine projections of the air service market over the next few years. The growth rates used in the projections are based on the experience of Rocky Mountain Airways serving the Colorado resort market with a similar service. It assumes that the appropriate promotion and marketing efforts will be used by AirBC including all-inclusive tour packages and through fares. It also assumes that the planned new accommodation and recreation facilities are developed at Whistler.

TABLE 1
WHISTLER AIR TRAVEL MARKET
BASE YEAR ESTIMATE
ONE-WAY TRAFFIC

	MARKET SHARE	WINTER	SUMMER	TOTAL
Eastern Canada	100%	4024	1180	5204
Central Canada	100	435	158	593
Alberta	50	618	288	906
B.C. (local and non-Vancouver)	5	1010	928	1938
Total Canada		6087	2554	8641
Eastern U.S.	100	976	413	1389
Southwest U.S.	100	2162	478	2640
Northwest U.S. (exclude Ore.&Wash.)	100	106	41	147
Oregon	75	404	109	513
Washington	25	3980	50	4030
Total U.S.		7628	1091	8719
Foreign (1)	100	554	276	830
Unknown (2)	50	312	281	593
		866	557	1423
		14581	4202	18783

(1) Japan in winter/Germany and U.K. in summer

(2) most booked by U.S. travel agents

Source: based on Whistler Resort Association surveys.

Two market projections have been developed. One projection assumes that both Vancouver Airport and Seattle Airport are used as gateways to interline connecting passengers and local boardings. The other projection assumes that Vancouver only is the gateway hub for interline and local boarding passengers. The attached Table 2 summarizes the air traffic estimates for the two projections.

It can be noted that the Vancouver/Seattle gateway projections are about 20% larger than the Vancouver-only gateway based on the assumption that a Seattle hub would attract local Washington State passengers which constitutes a large market share of the current Whistler area visitors.

The projections assume that the distant markets, Eastern Canada, Eastern U.S. and Southwest U.S. will experience the largest increases in growth for air service with the increased access to Whistler by connecting air carrier service.

TABLE 2
ONE-WAY PASSENGER PROJECTIONS

	VANCOUVER/SEATTLE GATEWAY	VANCOUVER-ONLY GATEWAY
Base Year	18,782	14,165
1984/85	21,465	16,790
1985/86	26,008	20,718
1986/87	31,253	25,443
1987/88	37,127	31,041
1988/89	43,414	36,995

4.0 TECHNICAL ANALYSIS

A 3,500 foot gravel runway has recently been completed at Pemberton Airport with the assistance of grants from the Federal and Provincial Governments. The airport is located approximately 32 kilometers from Whistler Village, representing a bus ride of approximately 30 minutes.

The Village of Pemberton has recently made a submission to Transport Canada requesting funds to extend and pave the runway. In addition, plans are being prepared to request the construction of a terminal building, weather station and navigational aids.

At the present time, there are no navigational approach aids at Pemberton Airport nor any airport lighting. Air service, therefore, is restricted to day, visual meteorological conditions. Given the terrain of the surrounding mountains in the Pemberton Valley and the weather patterns prevailing in the Coastal Mountain region, particularly during the winter months, a very high percentage of scheduled flights would be subject to cancellation due to weather. Meteorological records for Alta Lake weather station at Whistler indicate that one-third of the time the cloud ceiling limits are below 2,000 ft. and/or one mile visibility. During the months of December and January, over half the time weather is below this standard.

Reliable air service is required if the objective is to develop the Whistler area as a year-round, destination resort. It would be totally unacceptable for tour wholesalers providing destination tour packages which include air transportation to Whistler, to have to bus customers from Vancouver due to unsuitable weather conditions.

The De Havilland Aircraft Company of Canada Limited conducted a survey of the Pemberton Airport and surrounding terrain with a view to recommending what landing aids should be utilized in order to develop the required reliability needed for a

scheduled air service. Their recommendation is that a precision instrument approach is possible for the Pemberton Airport which will provide the appropriate landing guidance in poor weather conditions. Landing limits of a 500 ft. ceiling and a visibility of two miles can be achieved with a system using a microwave landing system in conjunction with non-directional beacons and high intensity airport approach lighting. The approach system assumes the use of the De Havilland Dash 7 aircraft with its short take-off and landing characteristics and the resultant steeper approach and take-off path of a STOL aircraft. The report is in the Appendix.

Transport Canada has also conducted a survey of the airport area and has concluded that the conventional instrument landing systems are not appropriate due to electronic signal interference from the terrain and the steep glideslope requirements. Transport Canada has received the submissions of the De Havilland recommendations for their review and approval.

The air service proposal for the Whistler/Pemberton service will use the De Havilland Dash 7 aircraft, a 50 seat pressurized airliner which is noted for its STOL characteristics and is in wide use throughout the world. AirBC will, in the near future, take delivery of its third Dash 7 aircraft.

Two air service patterns are being considered. The preferred alternative, which would best meet the needs of the travelling public is a route pattern which uses both Vancouver and Seattle gateways for direct air service to Whistler/Pemberton. This service pattern would offer, during the winter season, three daily round trips between Vancouver and Pemberton and two daily round trips between Seattle and Pemberton. During the summer season, one flight a day would be offered between Vancouver and Pemberton. In order to operate this proposed air service pattern, both the Canadian Transport Commission and the U.S. Government would have to approve the Seattle/Pemberton service. The second air service would provide four daily round trips in the winter between Vancouver and Pemberton but no service to Seattle. The summer service pattern would be one daily round trip between Vancouver and Pemberton.

The flying time between Vancouver Airport and Pemberton Airport is approximately 30 minutes while the flying time between the Seattle-Tacoma (Jackson) Airport is about 60 minutes. Using only the Vancouver-Pemberton air service produces some 815 flying hours a year. The Vancouver and Seattle air service, on the other hand, will generate some 1,265 flying hours; about half of the annual revenue hours to justify the economic use of a De Havilland Dash 7 aircraft. The additional flying hours that an air service to Whistler/Pemberton will generate will also improve the total aircraft fleet utilization of AirBC, particularly during the winter months when many of its other scheduled air routes have seasonal service frequency reductions due to lower winter travel demand.

The Vancouver/Seattle air service provides 96,000 available seats per year, while the Vancouver-only air service has 81,500 available seats. The passenger load factors for the two air services are noted in the attached Table 3. The Vancouver/Seattle air service has the higher passenger load factor despite the availability of additional seats.

It is estimated that the capital cost for the required navigation approach aids, airport lighting and air terminal building facilities will be $3.2 million. The annual airport operating and maintenance costs, including labour, are estimated to be some $111,000. The following itemizes the estimated capital and operating costs.

Item	Capital	Operating & Maintenance Annual
Navigation Aids		
- MLS/DME	$719,762	$29,200
- NDBs	131,538	4,400
- Remote controls	23,338	700
- MLS Back Azemuth	226,426	6,800
- Power generator	25,000	6,000
- Transportation	12,000	
- Engineering Site Report	101,000	
- Site Preparation	263,000	
- Flight Check	147,000	
- Utilities/Clearing, etc.	550,000	
	$2,199,046	$47,000
Airport Lighting		
- Runway End Identification	45,878	
- Runway lights	11,410	
- Taxiway lights	17,040	
- Rotating Beacon	9,500	
- Lighted windsock	5,000	
- Flood lights	60,000	14,000

Item	Capital	Operating & Maintenance
Approach Lighting		
- Precision Approach Position Indicator	$ 40,000	$
- Approach lights	25,200	
- LDIN (high intensity)	35,000	
- Regulator Control/ Generator Back-up	140,000	11,500
- Cable, etc.	84,000	
- Engineering report	25,000	
- Site preparation and installation	154,000	
	$689,528	$ 25,500
Terminal Building Area		
- Terminal building	200,000	
- enlarged aircraft apron	25,000	12,500
- Mobile equipment (donated)		
- Engineering report	25,000	
- Utilities/Site preparation	50,000	
	$300,000	$ 12,500
Runway Maintenance		10,000
Weed and Grass Control		750
Liability Insurance		7,500
Snow Compaction/Removal		6,000
Mobile Equipment/Fuel		500
Miscellaneous		1,000
		$25,750
	$3,188,574	$110,750
20% Contingency	637,714	
	$3,826,288	

TABLE 3
PASSENGER LOAD FACTOR

	1984/85		1985/86		1986/87	
	Van/Sea	Van Only	Van/Sea	Van Only	Van/Sea	Van Only
Passengers (two-way)	42,930	33,580	52,016	41,436	62,506	50,886
Available Seats	96,500	81,500	96,500	81,500	96,500	81,500
LOAD FACTOR	44.5	41.2	53.9	50.8	64.8	62.4

5.0 ALTERNATIVE GROUND TRANSPORTATION

Presently only ground transportation is available to visitors to the Whistler resort area. Air transportation would assist in improving the overall transportation system to Whistler. Ground transportation to Whistler has not been reliable and presents a serious problem which is expensive to solve. Both the railway line and the highway have been subject to frequent closures due to washouts and other hazards, particularly in the Horseshoe Bay-Squamish section of the route.

British Columbia Railway operates a daily passenger train from its North Vancouver station, leaving at 7:30 a. m. and arriving at Whistler two hours and 12 minutes later. The return train leaves Whistler at 6:15 p. m. arriving back at North Vancouver at 8:30 p. m. The one-way fare is $7.50. B.C. Rail uses self-propelled Budd diesel cars which were first put into service on the route in May of 1957, some 27 years ago. The six original Budd cars have only this year been supplemented with three re-conditioned cars acquired in Philadelphia. B.C. Rail have continually experienced losses of over $1 million each year from passenger services. It is estimated that to replace the original Budd cars will likely require $12 million in capital. There are no prospects to improve the economics of passenger rail service due to the high operating costs and low patronage.

The highway has been open since 1957. It is one of the most difficult roads to maintain since it is subject to high traffic volumes, has slide areas and bridge washouts, and is located along steep mountain slopes for most of the route. There have been numerous closures from a few hours to several days. Not only is it expensive to repair the highway due to closures, but the economic loss to communities such as Squamish, Whistler and Pemberton is substantial with the loss of business. In 1982, the Ministry of Transportation spent some $3.2 million

on road and bridge maintenance and snow removal on this highway. In the same year, some $7.4 million was expended in capital projects to improve the highway.

Recently, the Ministry of Transportation and Highways studied alternative routes to determine whether road access could be improved. Several routes were examined, each estimated to cost between $150 - $240 million to construct. The decision was to up-grade the existing highway between Horseshoe Bay and Britannia, the most difficult section of the highway. This program will cost some $140 million to complete over the next 10 years. The construction cost is over $16 million per mile in this section of the road. This compares to $1 million per mile in the Britannia-Cheakamus Canyon section of the highway. It can be seen that improving highway access is very expensive to build and to maintain.

Bus service is provided daily to Whistler by Maverick Coach Lines. Buses leave downtown Vancouver at 2:00 p.m. and 7:00 p.m. and arrive at Whistler at 4:20 p.m. and 9:20 p.m. respectively. The trip to Vancouver leaves Whistler at 8:30 a.m. and 6:30 p.m., arriving in Vancouver at 10:45 a.m. and 8:45 p.m. During the winter months a third bus is added for the convenience of skiers. This bus leaves Vancouver at 6:30 a.m. and arrives at Whistler at 9:00 a.m. The return winter bus leaves Whistler at 4:00 p.m. and arrives in Vancouver at 6:45 p.m.; 2 hours and 45 minutes later. The one-way fare is $10.00.

Private and rental automobile is the most common means of transportation to Whistler. During the winter weekend peak times, the highway capacity is frequently reached which adds considerably to the driving time between Vancouver and Whistler. It also increases the frequency of road accidents when the route is congested. It is estimsted that a visitor using a private automobile would expend $65 to drive from Vancouver to Whistler and back, while from Seattle to Whistler and back the private automobile would cost $182.50*. A compact rental automobile for use to and from Whistler and rented at Vancouver Airport is estimated to cost the average

* based on Federal Government automobile allowance of April 1, 1984 of 25¢/km.

winter visitor party $193.55 ($71.69/person). The summer visitor party, due to a shorter stay at Whistler, is estimated to expend $107.65 on rental automobile charges ($53.83/person).

The planned expenditures for highway improvements will mainly benefit the day visitor to Whistler. The day visitor, however, makes expenditures of less than half of those which are overnight visitors to the Whistler resort area. It is the overnight visitor who is the prime market for air service. The air visitor profile information, collected by the Ministry of Tourism, shows that air visitors have significantly higher family incomes, are slightly older, will use high quality facilities and amenities and frequently are on pleasure/business vacation trips. The air visitor to the Whistler resort area, therefore, can provide significant benefits to the Whistler economy based on the longer stay and the higher per capita expenditures on accommodation, food, recreation, shopping and other items. Capital expenditures on air transport facilities, therefore, will provide relatively more benefits to the Whistler resort economy and the senior levels of government, in terms of additional revenue taxation, than would expenditures on highway improvements for day visitors.

6.0 PROJECT BENEFITS

An air service to the Whistler/Pemberton area will provide very significant benefits to the local economy and the Province of British Columbia and Canada. These benefits are both monetary and non-monetary. This section will highlight those benefits resulting from the air service.

6.1 Construction Benefits

The construction phase of the project provides benefits in terms of employment, equipment and material expenditures and taxation revenue.

6.1.1 Employment - It is expected that during the construction phase some 36 man-years of direct employment will be generated. Installing the navigation equipment will provide the largest employment with some 24 man-years need for clearing, site preparation, utility services, equipment installation and testing. Airport lighting will require about four man-years to prepare and install the lighting. The airport terminal building and enlargement of the aircraft apron will employ about 8 man-years of employment. Wages and salaries are expected to be $870,000 for the construction period. There will also be some employment from the engineering studies and the manufacture of the equipment. It is likely that the equivalent of three man-years will be needed to project engineering and about 20 man-years to manufacture the navigation and lighting equipment; all assumed to be manufactured in Canada.

Based on a construction employment multiplier of 1.8 it can be expected the indirect employment due to the airport construction will be 66 man-years. These indirect jobs are those additional jobs created by the companies providing construction materials, services to the workers in Pemberton and so forth. The estimates wages and sales resulting from indirect employment is estimated to be $1,566,000.

Income tax from the direct and indirect employment during the construction phase is estimated in Table 4 attached.

TABLE 4
CONSTRUCTION EMPLOYMENT INCOME TAX

	Number Employed	Wages and Salaries	Federal Tax	Provincial Tax	Total Tax
Direct					
Construction Employment	36	$869,959	$101,785	$47,848	$149,633
Engineering	3	71,000	8,307	3,905	12,212
Manufacturing	20	474,000	55,458	n/a	55,458
	59	$1,414,959	$165,550	$51,753	$217,303
Indirect					
Construction Employment	66	$1,565,926	$183,213	$86,126	$269,339

6.1.2 Expenditures - During the construction phase, expenditures will be made for navigation and lighting equipment, power generators, utilities and construction materials and supplies.

Navigation equipment expenditures are extimated to be $1,138,000 and an additional $244,000 in materials and supplies to install the navigational equipment.

Airport lighting equipment expenditures will likely total $410,000 and the construction materials for installing the lighting will add about $50,000 to the total.

The air terminal building construction is likely to require $60,000 in building supplies and $15,000 for other site preparation construction materials. The enlarged aircraft apron will need about $7,500 in gravel and other construction supplies.

There are Federal and Provincial sales taxes applicable to construction expenditures. There are also corporate income taxes. The following summarizes these various taxes to the Federal and Provincial Governments.

Navigation Equipment (assumes 95% taxable)	
Federal Sales tax @9%	$96,278
Provincial Sales tax @7%	75,681
Lighting Equipment (assumes 95% taxable)	
Federal Sales tax @9%	35,032
Provincial Sales tax @7%	27,247
Construction Material (assumes 95% taxable)	
Federal Sales tax @5%	17,710
Provincial Sales tax @7%	24,794
Total Sales Tax on Equipment and Material	
Federal Sales tax	149,020
Provincial Sales tax	127,722
	$276,742

The corporate income taxes generated by the equipment manufacturers, construction material firms and the project contractors are estimated to be the following:

Navigation Equipment (assumes 6% profit on sale)	
Federal corporate income tax @20%	$13,513
Provincial corporate income tax	n/a
Airport Lighting (assumes 6% profit on sale)	
Federal corporate income tax @20%	3,278
Provincial corporate income tax	246
Construction (assumes 6% profit on project)	
Federal corporate income tax @20%	2,983
Provincial corporate income tax @12%	1,790
Total Corporate Income Tax	
Federal	19,774
Provincial	2,036
	$21,810

6.1.3 Construction Phase Benefit Summary - It can be noted that during the construction phase there are over $500,000 in Federal and Provincial taxes resulting from direct employment and expenditures on the project. The Federal government collects $334,344 in direct taxes while the Provincial government collects $181,511. The project will provide important benefits to the Pemberton area as it can be expected that a large proportion of the construction materials and supplies could be purchased in the local area and that a large amount of the 36 man-years of estimated employment could be jobs for Pemberton residents.

6.2 Operating Benefits

It is, of course, the operating phase of the project which provides the most substantial benefit since the benefits are repeated annually, not just for a relatively short construction period. The calculation of benefits resulting from the operating phase are varied and have a significant impact on the Pemberton, Whistler, AirBC, air visitors and the Federal and Provincial governments. It should be noted that the operating benefits in some cases are different for a Vancouver/Seattle gateway air service in comparison to a Vancouver gateway only. Where there are differences, they are noted.

6.2.1 Employment - The air service will provide new employment opportunities, principally in Pemberton and Whistler.

At Pemberton, the new jobs will be directly related to the airport. The following outlines the minimum employment needs of the air service.

Village of Pemberton Responsibility	
Airport Management - duties to be assumed by Village Alderman	no salary
Airport Maintenance - one full-time for general airport maintenance	$18,000
Electrical/Mechanical Maintenance - part-time for navigation/lighting, etc.	14,000
Janitor/Watchman - one full-time	14,000
Fire-Fighters - volunteers under direction of Village Fire Chief	no salary
Total Wages and Salaries	$46,000
Federal Government	
Aviation weather - assumed to be contracted by Atmospheric Environment Services to local residents (e.g. ticket agents)	$50,000
Customs Officer/RCMP - needed for Seattle service	25,000
Total Wages and Salaries	$75,000
AirBC*	
Station Supervisor - one working supervisor	$20,000
Ticket Agents (equivalent of 2 full-time)	30,000
Ramp Personnel (equivalent of 2 full-time)	30,000
Total Wages and Salaries	$80,000
Private Companies	
Bus Driver (one full-time driver)	$20,000
Taxi Driver (part-time)	7,000
Car Rental (part-time)	5,000
Total Wages and Salaries	$32,000

*AirBC personnel costs stipulated in air carrier's administration and overhead.

The indirect employment opportunities generated from the Pemberton Airport jobs are estimated to be relatively low. An employment multiplier of 1.8 has been assumed to have been generated from the equivalent of 10 man-years of direct employment related to the airport. This multiplier produces an indirect employment of 18 man-years with annual wages and salaries of $374,400.

Whistler resort area's direct employment is a result of air visitor expenditures made at Whistler and the assumption that about half of the expenditures constitute the labour component of the total. It also assumes that

one man-year of employment is created with $23,700 of labour expenditures, the Provincial average salary and wage. Since are visitors will increase each year, the expenditures will also increase annually and, therefore, additional employment will be generated.

It is estimated that in the base year there is some 135 man-years of employment attributable to visitors which could be air visitors if an air service to Pemberton Airport was available. These target market visitors likely now travel by air to Vancouver and therefore would use an interline service if it were available at Vancouver and Seattle Airports. The estimated base year wages and salaries total $3.2 million. In the second year of the air service, it is assumed that an additional 22 man-years of employment will be generated. Should there be only air service from Vancouver, the air travel market is slightly reduced and, therefore, the expenditures and employment are lower.

Indirect employment resulting from direct employment at Whistler is based on similar assumptions as to air visitor expenditures creating employment. The employment multiplier, based on a survey of articles on tourism, indicates that an employment multiplier of 2.42 is appropriate. The base year indirect employment with the Vancouver and Seattle gateway service is estimated to be 327 at an estimated $8.7 million in wages and salaries. An additional 53 man-years of employment is generated in the first year of the air service. It should be noted, however, that indirect employment may be generated for outside of the Whistler/Pemberton area and would include additional staff to a Toronto travel agency, for example, that sells air packages to Whistler. The attached Table 5 shows the direct and indirect employment from air visitor expenditures at Whistler.

In addition to increased employment at Pemberton and Whistler, there may be some additional employment at Vancouver and Seattle. AirBC will not likely increase its staff levels at Vancouver since the peak winter period for the Whistler/ Pemberton air service occurs when other air routes

TABLE 5
WHISTLER EMPLOYMENT (MAN-YEAR EQUIVALENT)

	Base Year		1984/85		1985/86	
	Sea/Van	Van Only	Sea/Van	Van Only	Sea/Van	Van Only
Direct	135	99	157	119	189	146
Marginal Addition	-	-	22	20	32	27
Indirect	327	240	380	288	457	353
Marginal Addition	-	-	53	48	77	65

are not demanding. Should the summer service warrant the personnel, part-time assistance may be employed. In the case of air service to Seattle, AirBC will need to contract ticket agents and ramp personnel for the winter period. It would likely transfer an existing Vancouver employee to Seattle to supervise the winter operation. U.S. Customs may also need some assistance to process returning U.S. citizens from Whistler. The possible Vancouver and Seattle employment has not been calculated nor their wages and salaries.

Income tax revenues to the Federal and Provincial governments as a result of employment are substantial. The income tax calculations assume an annual salary of $23,700 and that 60% of those employed are married with two children, while the remainder are single.

The Pemberton direct employment figures, assuming that a Customs Officer is located at Pemberton Airport for the Seattle-Pemberton service, generates some $40,000 in income tax each year. The Federal government receives $27,200 of the income tax and the Province of British Columbia the remaining $12,800. Based on an indirect employment wages and salary total of $419,400, the income tax collected increases to $72,000, of which the Federal government's portion is $49,000 and the B.C. government $23,000.

The Whistler direct employment generated income tax increases each year as air visitor expenditures increase. The income tax also varies as to whether air service is provided to both Vancouver and Seattle or Vancouver. The larger market of the Vancouver and Seattle gateways, as an example, will generate nearly $560,000 in income tax in the base year. The attached Table 6 summarizes the employment income tax for the first years of air service using both Vancouver and Seattle for both direct and indirect employment.

TABLE 6
EMPLOYMENT INCOME TAX
WHISTLER
VANCOUVER AND SEATTLE GATEWAYS

DIRECT	BASE YEAR	1984/85	1985/86	1986/87
Federal	380,503	435,340	524,473	629,699
Provincial	178,880	204,647	246,547	296,012
	559,383	639,987	711,020	925,711
Marginal Addition	-	80,604	131,033	154,691
INDIRECT				
Federal	1,023,552	1,170,909	1,410,834	1,693,889
Provincial	481,157	550,427	663,212	796,272
	1,504,709	1,721,336	2,074,046	2,490,161
Marginal Addition	-	216,627	352,710	416,115

6.2.2 Operating Expenditures - There are a number of expenditures which will be made during the operating phase which will generate benefits. A large portion of those benefits are the various tax revenues which will flow to the Federal and Provincial governments from various taxes.

The most significant benefits originate from the expenditures made by the air visitor. There are, however, benefits generated from the operation of the airport and its associated navigation and lighting system. There are other benefits from the expenditures of AirBC to operate and maintain the De Havilland Dash 7 aircraft to be used on the service. The following attempts to quantify some of the benefits made from expenditures.

6.2.2.1 Whistler Generated Expenditures - An examination of the air visitor expenditures which would be made for accommodation, food, recreation, entertainment, shopping and miscellaneous expenditures. Based on information collected by the Whistler Resort Association and the Ministry of Industry and Small Business, it was determined that the average overnight visitor during the winter season spends about $100 a day at Whistler. During the summer months, the daily expenditure falls to $80 a day due to decreased accommodation and recreational spending. Based on these daily expenditures, an estimate was made of the probable expenditures by air visitors. Indirect expenditures were also calculated using an input-output multiplier of 2.69 which is an average of tourism expenditure multipliers of this type. It can be noted that this type of multiplier is slightly higher than the employment multiplier previously used to calculate indirect employment. Table 7 summarizes the total direct and indirect expenditures for the Vancouver/Seattle gateways. The Vancouver gateway only expenditures are lower.

The Provincial sales tax on these expenditures of 7% generates substantial tax revenues for the British Columbia government. If it is assumed that all items are subject to the Provincial sales tax, the direct Provincial sales tax on expenditures in the base year is $455,000 for the Vancouver/Seattle gateways

TABLE 7
AIR VISITOR EXPENDITURES ($)
WHISTLER
VANCOUVER/SEATTLE GATEWAYS

	BASE YEAR	1984/85	1985/86	1986/87
Direct	$ 6,504,320	$ 7,440,720	$ 8,985,360	$10,764,080
Indirect	17,496,621	20,015,537	24,116,818	28,955,375
Marginal Additional Direct		936,400	1,524,640	1,798,720
Marginal Additional Indirect		2,518,916	4,101,281	4,838,557

TABLE 8
PROVINCIAL SALES TAX
VANCOUVER/SEATTLE AIR SERVICES

	BASE YEAR	1985/85	1985/86	1986/87
Direct Tax	455,302	520,850	627,575	753,485
Marginal Addition	-	97,548	106,725	125,910
Indirect Tax	1,224,764	1,401,087	1,688,198	2,018,876
Marginal Addition	-	176,327	287,090	388,698

air service. The Vancouver only service generates a lower figure of $333,000 during the base year. Table 8 summarizes the Provincial sales tax calculations for the Vancouver/Seattle air services for both direct and indirect expenditures. The indirect expenditures assume all expenditures made in British Columbia which is not likely the case.

If it can be assumed that an average 6% profit is made by corporations on gross sales of goods and services to air visitors, an estimate of corporate income tax can be calculated. Table 9 shows the estimate for both direct and indirect expenditures.

6.2.2.2 Pemberton Generated Expenditures - Most of the annual expenditures are associated with the operation and maintenance of the airport at Pemberton. It is assumed that a number of the expenditures will not be subject to taxation since the Village of Pemberton is the airport operator. The following are the identified operating costs which the airport will require each year. These operating and maintenance costs are only broad estimates:

Navigation (utilities diesel power generator, inspection, maintenance, etc.)	$47,000
Airport Lighting (utilities, light bulb replacement, cable inspection, etc.)	25,000
Air Terminal Building (utilities - hydro, telephone, heat, cleaning, painting, etc.)	12,500
Airport Liability Insurance ($30 million)	7,500
Runway rolling, stabilization, new gravel, dust control	10,000
Weed and grass control (5 x $150)	750
Snow Removal/Compaction (20 x $300)	6,000
Mobile Equipment and Fuel	500
Miscellaneous	1,000
	$110,750

Wages and salaries are about $46,000 of the operating expenses, therefore, materials and supplies are about $64,750. Most of the materials and supplies can be supplied by British Columbia companies to the Village of Pemberton. While it is assumed that Provincial sales taxes do not apply, there are corporate income taxes. Federal corporate income taxes

TABLE 9
CORPORATE INCOME TAX
VANCOUVER/SEATTLE AIR SERVICE

DIRECT	BASE YEAR	1984/85	1985/86	1986/87
Federal	78,052	89,289	107,584	129,169
Provincial	46,831	53,573	64,550	77,501
	124,883	142,852	172,134	206,670
Marginal Addition	-	17,969	29,282	34,536
INDIRECT				
Federal	209,960	240,187	289,402	347,465
Provincial (assume B.C. Company)	125,976	144,112	173,641	208,479
Marginal Addition	-	48,363	78,744	92,901

TABLE 10
CANADIAN AIR TRANSPORTATION*
VANCOUVER/SEATTLE AND VANCOUVER ONLY

1984/85		1985/86		1986/87		1987/88	
Van/Sea	Van Only	Van/Sea	Van Only	Van/Sea	Van Only	Van/Sea	Van Only
156,218	134,722	188,880	166,240	227,691	204,154	271,601	249,072

* Excludes any air transportation tax on air travel to Vancouver or Seattle gateway. In 1982, the Federal Government collected over $550 million in Air Transportation Tax revenue.

on this amount, assuming a 6% profit on sales, amounts to $777 while the Provincial corporate tax is $466 for a total of $1,243.

In order to assist in covering site operating costs of the airport, the Village of Pemberton will collect concession and other fees from air visitors, bus and rental automobile agents, AirBC and other itinerant and locally based aircraft. The following outlines these revenue sources. Again, since these revenues are collected by the Village of Pemberton, they are tax exempt.

- Air Passenger Boarding Fee ($1.00 per passenger boarded). Increases each year based on passenger forecast - example, Vancouver/Seattle service 1986/87	$31,253
- Pemberton Bus/Taxi Concession Fee (5% of gross revenue). Increases each year based on passenger forecast - example, Vancouver/Seattle service	15,626
- Dash 7 Landing Fee ($26 per landing) see subsequent section for details - example, Vancouver/Seattle revenue	25,090
- Air Terminal Building Lease to AirBC (5 year lease rate)	6,100
- Air Terminal Building Concession Fees (advertising of Whistler accommodation, food, etc., vending machines, lockers, etc.)	2,000
- General Aviation revenues	
Aircraft tie-down space (local aircraft 10 @$120 per month)	1,200
Aircraft tie-down space (itinerant, $7.50 overnight)	1,500
Aviation fuel concession (3¢/gal 20,000 gal. per year)	600
Hangar lot leases (5 lots @ 150/month)	9,000
Other General Aviation Concessions	500
	$92,869

It is anticipated that the bus/taxi service would generate significant revenues for a Pemberton (or Whistler) based transportation company. It is expected that a 50 passenger bus will meet each flight and take passengers to and from Whistler. Based on a $5.00 one-way fare, some $312,500 in gross revenue would be generated in 1986/87 with the Vancouver/ Seattle gateways air service. It is estimated

that about $15,000 of the total estimated operating expenses ($125,000) would be subject to the Provincial sales tax or about $1,050 per year. It is assumed that about 78,000 litres of fuel would be consumed which would generate approximately $2,500 in Federal fuel taxes and $4,000 in Provincial fuel taxes. Corporate income tax, assuming that 6% of the profit is subject to taxation, would provide tax on the bus operation of $2,250 for the Federal government and some $1,350 to the Province.

6.2.2.3 AirBC Expenditures - AirBC will generate a substantial amount of economic benefits when operating the proposed air service. These benefits will flow to the airline, the Village of Pemberton, Federal and Provincial governments.

Revenue generation from passenger and freight traffic is one area where benefits can be identified. A one-way fare of $59 between Vancouver and Pemberton is expected to produce an effective yield of $50.15 per person with the various applicable fare discounts. Similarly, an $85.00 one-way fare between Seattle and Pemberton will yield an average fare per passenger of $72.25. Air freight tariffs are assumed to be 25¢/lb. with minimum shipments of $18.00. Using the Vancouver/Seattle service as an example, it is expected that the 1984/85 period would produce over $2.5 million in passenger and freight revenues. In 1986/87, the revenues are expected to increase to over $3.6 million.

Air passenger tickets are subject to a Canadian Air Transportation Tax of 8% of the ticket value for boardings in Canada on scheduled airlines. The U.S. has a similar 8% air transportation tax for passengers boarded. This tax is collected by the airline on behalf of the Federal Government. Table 10 shows the revenues generated by this tax.

Landing fees are another benefit to Vancouver, Pemberton and Seattle. The De Havilland Dash 7 is assessed a landing fee of $26 per landing by Transport Canada at Vancouver Airport. It is

TABLE 11
ESTIMATED AirBC CORPORATE INCOME TAX

	1984/85		1985/86		1986/87	
	Van/Sea	Van Only	Van/Sea	Van Only	Van/Sea	Van Only
Net Revenue	272,249	317,036	778,255	675,015	1,370,360	1,158,933
Federal Tax	54,450	63,407	155,651	135,003	274,072	231,787
Provincial Tax	32,670	38,044	93,391	81,002	164,443	139,072
	87,120	101,451	249,042	216,005	438,515	370,859

assumed a similar fee would be applied by the Port of Seattle and the Village of Pemberton. Based on an air service to both Vancouver and Seattle, there would be some 1,500 landings a year, or $50,180. Some $25,090 would be allocated to Pemberton Airport and $17,290 to Vancouver Airport and the remainder in equivalent U.S. funds to Seattle-Tacoma Airport. A service only between Vancouver and Pemberton would generate some $42,380 in landing fees, equally divided between Vancouver and Pemberton.

Aviation fuel taxation is another area where the Federal and Provincial governments receive revenues. Based on an hourly consumption of 1,023 litres, the Dash 7 aircraft will consume 1,294,095 litres of Jet B fuel on the Vancouver/Seattle air service. The Vancouver only gateway will consume 833,745 litres of fuel each year of the service.

Based on a Federal tax of $.0320/litre and a Provincial tax of $.0505/litre, this would produce some $41,411 in tax revenue for the Federal government and $65,353 for the Provincial government for the Vancouver/Seattle service; a total aviation fuel tax of $106,763. The calculation assumes that all the fuel is purchased in Canada. Due to the lower number of hours flown, the Vancouver only air service generates $68,789 in total aviation fuel revenues with the Province collecting $42,104 of this amount.

Other AirBC expenditures to operate and maintain will not necessarily generate new expenditures directly attributable to the proposed air service. Maintenance burden, insurance, depreciation are now included in total fixed fleet expenditures and are not variable expenditures. There may, however, be some need for additional expenditures on air crew, maintenance and perhaps some elements of overhead and administration which could be variable and therefore linked to some extent with the new service.

It is assumed that about half of the variable expense for the Vancouver/Seattle service could result in additional expenditures and only 25% for the Vancouver only service based on the hours flown for the two air services.

The following are the relevant marginal variable expenditures.

	Vancouver/Seattle	Vancouver Only
Flight Crew	$71,318	$22,616
Direct Maintenance		
- Labour	69,069	21,903
- Materials/Supplies	69,070	21,903
Other Expenses	11,565	3,668

Employment income tax as a result of the above marginal expenditures would result in Federal income tax of $16,425 and Provincial income tax of $7,721 for the Vancouver/Seattle air service. similarly, the Vancouver only service would generate $5,209 in Federal income tax and $2,448 in Provincial income tax.

Materials and supplies would generate $5,644 in Provincial sales tax if all items were taxable for the Vancouver/Seattle air service. The Vancouver only service would generate $1,790 in Provincial sales tax revenue.

Corporate income tax paid by AirBC as a result of the new service varies as to the Vancouver/ Seattle service and the Vancouver only service. Assuming that 20% is the Federal tax rate and 12% the Provincial tax rate on net revenue. Table 11 shows the expected corporate income taxes.

6.2.3 Operating Phase Benefits Summary - Federal and Provincial employment income tax from direct employment in 1986/87 is estimated to total nearly $1 million. The Federal government will receive about $640,000 of the total and the Province the remaining employment income tax.

In 1986/87 Provincial sales tax on direct operating expenditures total over $750,000. Direct Federal corporate income tax in 1986/87 totals over $400,000 while the Provincial corporate income tax generates an additional $240,000.

The Canadian Air Passenger Tax collected by AirBC for only the air service to Whistler/ Pemberton will, in 1986/87, generate $225,000 in revenue to the Federal government. Landing fees collected by Transport Canada and the Village of Pemberton and the Port of Seattle are $50,000 per year. Aviation fuel taxes generate some $40,000 to the Federal government and $65,000 to the Provincial government each year.

The total direct taxes collected by the Federal government in 1986/87 are estimated to total $1,412,000 while the Provincial government will collect approximately $1,390,000. Half of the Provincial tax revenue is from the Provincial sales tax on expenditures.

6.3 Other Benefits

There are other benefits which the air service project will generate. These benefits, to some extent, are non-monetary. The following sub-sections outline some of these other benefits.

6.3.1 Instrument Approach Benefits - The value of an instrument approach to Pemberton Airport has been estimated. There are no ceiling and visibility weather records available for Pemberton Airport but historical data is available from the Alta Lake weather station located at Whistler. The Alta Lake information indicates the number of occurrences when the ceiling is below 2,000 ft. and/or one mile visibility. Weather conditions below these limits can be considered instrument meteorological conditions when aircraft must operate under instrument flight rules (IFR). The Alta Lake observations have been averaged by month for several years, therefore represent a good probability for the expected weather conditions for each month. It should be noted that the Alta Lake station is located 32 km away from Pemberton and is at a higher elevation, therefore the Alta Lake weather patterns are only a proxy for the expected conditions at the Pemberton Airport.

The Alta Lake records show that nearly one-third of the weather observations recorded instrument flying weather. During the months of December and January, half the month records poor weather conditions.

Using the 1986/87 passenger forecast to determine air carrier revenue, Table 12 shows the value of an instrument landing system at Pemberton Airport.

It can be noted from the Table that the net revenue earned from being able to operate in instrument flying conditions is $477,000. It is recognized that even with instrument landing aids, not all flights will be able to operate into Pemberton Airport. There will be occasions when wind conditions are not favourable for the instrument approach. There will also be occasions when the weather limits are even below 500 ft. and two miles visibility. The experience of Rocky Mountain Airways, using the microwave landing system as a navigation aid is about 97% trip completion record.

The value of having an instrument landing system can also be viewed from the point of view of lost revenue to the Whistler resort area as a result of the aircraft not being able to complete the trip. In 1986/87 it is estimated that without the instrument landing system, some 11,000 passengers would not have been carried on the air service due to weather. If these passengers do not make alternative plans to reach Whistler, the Whistler resort area will have lost over $4 million in expenditures which these air tourists would have made in Whistler for accommodation, food, recreation and so forth.

6.3.2 International Balance of Payments - A substantial number of the air visitors originate in the United States, Japan, Germany, United Kingdom and other countries. Their expenditures assist the Canadian balance of payments by attracting foreign currency exchange into Canada. It can also be stated that the air

TABLE 12
INSTRUMENT LANDING VALUE
VANCOUVER/SEATTLE AIR SERVICE
1986/87

MONTHS	% IFR WEATHER	TOTAL TRIPS VAN	TOTAL TRIPS SEA	IFR TRIPS VAN	IFR TRIPS SEA	IFR REVENUE	IFR COSTS	IFR NET REVENUE
JANUARY	46.9	93	62	44	29	$ 281,291	$183,600	$ 97,691
FEBRUARY	38.0	84	56	32	21	204,124	133,200	70,924
MARCH	30.7	93	62	19	19	153,658	102,600	51,058
APRIL	22.7	60	30	13	7	77,034	48,600	28,434
MAY	14.1	31		4		14,189	7,200	6,989
JUNE	20.3	30		6		21,283	10,800	10,483
JULY	12.5	31		4		14,189	7,200	6,989
AUGUST	17.4	31		5		17,736	9,000	8,736
SEPTEMBER	23.5	30		7		24,830	12,600	12,230
OCTOBER	38.2	31		12		42,566	21,600	20,966
NOVEMBER	39.5	60	30	23	12	134,777	84,600	50,177
DECEMBER	54.3	93	62	50	34	324,845	212,400	112,445
	28.2	667	302	219	122	$1,310,522	$833,400	$477,122

service may assist in keeping a larger portion of Canadian visitors in Canada by increasing the access to Whistler. Expenditures made in Canada by Canadian visitors also help the balance of payments.

Table 13 identifies foreign currency payments made in Canada directly associated with the air service.

6.3.3 Value of Time Benefits - The proposed air service provides time savings over ground transportation which can be valued. The ground transport time from Vancouver Airport to Whistler, a distance of 145 km, takes two hours and 15 minutes to travel. The air service takes 30 minutes, plus an additional 30 minutes from the Pemberton Airport to Whistler by bus. The air service, therefore, provides a time savings of one hour and 15 minutes. The time savings are even greater from Seattle. The mileage from Seattle to Whistler is 365 km and takes about five hours and 40 minutes to drive. The air time from Seattle-Tacoma Airport to Pemberton is 60 minutes. An additional 30 minutes is again required for the bus trip to complete the trip to Whistler. The air service mode, therefore, is four hours and 10 minutes faster than the ground transportation method.

Table 14 shows the time saved by using the air service between Vancouver/Seattle and Whistler.

The value of the time saved is based on the assumption that the average air visitor has an annual income of $35,000 and that 1950 hours a year is the number of hours worked. The value of liesure time has been estimated in the literature to be between 15 and 115% of business time. A figure of 20% was selected which yields a liesure time value of $3.60 per hour. Using this figure and the hours saved from the previous table results in the value of time saved by using the air service. Table 15 shows the value of time saved for the first few years of the air service.

TABLE 13
BALANCE OF PAYMENTS
VANCOUVER/SEATTLE SERVICE

	Base Year	1984/85	1985/86	1986/87
Air Fares (does not include connecting carriers)	$1,314,828	$1,497,668	$1,808,395	$2,157,477
Whistler Expenditures	3,660,880	4,175,200	5,033,680	6,016,800
TOTAL	$4,975,708	$5,672,868	$6,842,075	$8,174,277

TABLE 14
TIME SAVING (HOURS)
VANCOUVER/SEATTLE SERVICE

	Base Year	1984/85	1985/86	1986/87
Vancouver Gateway	30,117	34,925	42,952	52,415
Seattle Gateway	56,116	62,448	73,546	85,711
	86,233	97,373	116,498	138,126

TABLE 15
VALUE OF TIME SAVED
VANCOUVER/SEATTLE GATEWAYS

	Base Year	1984/85	1985/86	1986/87
Vancouver Gateway	$108,421	$125,730	$154,627	$188,694
Seattle Gateway	202,018	224,813	264,765	308,560
	$310,439	$350,543	$419,392	$497,254

6.3.4 Whistler Resort Area Benefits - The proposed air service will provide a number of benefits to the Whistler resort area by improving its accessibility.

Most importantly, the air service to Whistler/Pemberton will assist the Ministry of Tourism in achieving its goal of attracting additional tourists to British Columbia who will stay longer and contribute more to the Provincial economy. The proposed air service will open a new tourist market to the Whistler resort area. This new market will be attracted to Whistler because of the ease of access created by air service and the incentive of joint airline fares to stimulate long distance travel.

The air visitors using the air service will provide a substantial economic stimulus to the Whistler resort area. These additional visitors will use existing under-utilized accommodation capacity and will assist in justifying the capital expenditures for planned accommodation. Air visitors will use the restaurant facilities, purchase ski lift tickets, pay golf fees, make purchases in the local shops and retail outlets. It is estimated that these expenditures will be in the millions of dollars each year. (See Table 7).

The proposed air service will also greatly benefit the total transportation system. The present ground transportation system has inhibited the growth potential of the Whistler resort area. Road closures, congested sections of the highway, and the mountain terrain with its steep gradients and curvature have all affected the full development of Whistler as a year-round destination. The air service will improve access by providing a reliable all-year transportation alternative to Whistler.

In time of road and rail closure, the air service could also prove to be a vital transportation link for Whistler and Pemberton to receive goods and services and perhaps serve emergency evacuation needs.

6.3.5 Expo '86 Benefits - Vancouver will host the 1986 World Exposition on Transportation and Communications. Expo '86 is fully sanctioned by the 46 nation International Bureau of Expositions based in Paris. Some 31 nations from six continents have already agreed to participate in the Exposition. It is expected that upwards of 40 nations, plus Canadian Provinces and several American State governments will be displaying their transportation and communications technology. Attendance is projected for 15 million visits to the exposition and many of these visitors will be from the participating nations.

The proposed air service can be a practical demonstration of Canadian transportation and communication for those visitors to the exposition. Air visitors who wish to visit the Whistler resort can use a Canadian built STOL aircraft to reach Pemberton Airport. At Pemberton Airport a Canadian manufactured microwave landing system will be used in conjunction with Canadian made beacons and radio communications. This demonstration could serve as stimulus to support Canadian marketing efforts to sell aircraft, navigation, communication and other technology to those nations participating in Expo '86.

6.4 Project Benefits Summary

Construction Benefits

36 man years of direct employment @ $870,000
in wages and salaries
additional man years for engineering and
equipment manufacturing
66 man years of indirect employment @ $1,566,000
in wages and salaries
value of equipment, materials and supplies $1,924,500

Tax and other Revenues	Federal	Provincial
- direct employment income tax	101,785	47,848
- sales tax	149,020	127,722
- corporate income tax	19,774	2,036
	$270,479	$177,606

APPENDIX

MARKET ANALYSIS

TECHNICAL ANALYSIS

PROJECT BENEFITS

Project Benefits 10 - Employment - Whistler Vancouver Gateway Only

Project Benefits 11 - Employment Income Tax Vancouver/Seattle Gateways

Project Benefits 12 - Employment Income Tax Vancouver Gateway Only

Project Benefits 13 - Provincial Sales Tax on Whistler Expenditures - Vancouver/Seattle Gateways

Project Benefits 14 - Provincial Sales Tax on Whistler Expenditures - Vancouver Gateway Only

Project Benefits 15 - Aviation Fuel Tax Vancouver/Seattle Gateways

Project Benefits 16 - Air Transportation Tax Vancouver/Seattle Gateways

Project Benefits 17 - Air Transportation Tax Vancouver Gateway Only

Project Benefits 18 - Aircraft Landing Fees Vancouver/Seattle Gateways and Vancouver Gateway Only

APPENDIX

MARKET ANALYSIS 1

WHISTLER AREA
OVERNIGHT VISITORS - TOTAL

	WINTER	SUMMER	TOTAL
Eastern Canada	4,024	1,180	5,204
Central Canada	435	158	593
Alberta	1,236	576	1,812
B.C.	20,192	18,552	38,744
	25,887	20,466	46,353
Eastern U.S.	976	413	1,389
Southwest U.S.	2,162	478	2,640
Northwest U.S. (excluding Ore./Wash.)	106	41	147
Oregon	539	145	684
Washington	15,918	4,076	19,994
	19,701	5,153	24,854
Foreign	554	276	830
Unknown	624	562	1,186
	1,178	838	2,016
	46,766	26,457	73,223

Source: Based on 1982/83 Winter Survey and 1983 Summer Survey of Whistler accommodation conducted by Ecosign on behalf of Whistler Resort Association.

APPENDIX

MARKET ANALYSIS 2

AIR TRAFFIC ESTIMATE - BASE YEAR CALCULATION
VANCOUVER/SEATTLE GATEWAYS
ONE-WAY PASSENGERS

	AIR TRAVEL[1] MARKET SHARE	WINTER	SUMMER	TOTAL
Eastern Canada	100%	4,024	1,180	5,204
Central Canada	100	435	158	593
Alberta	50	618	288	906
B.C. (local and non-Vancouver)	5	1,010	928	1,938
		6,087	2,554	8,641
Eastern U.S.	100	976	413	1,389
Southwest U.S.	100	2,162	478	2,640
Northwest U.S. (exclude Ore/Wash)	100	106	41	147
Oregon	75	404	109	513
Washington	25	3,980	50	4,030
		7,628	1,091	8,719
Foreign[2]	100	554	276	830
Unknown[3]	50	312	281	593
		866	557	1,423
		14,581	4,202	18,783

(1) Assumed to be connecting air passengers except local Pemberton/Whistler boardings.
(2) Japan in winter season and Germany and U.K. in the summer season are main foreign origins.
(3) Most "unknowns" are booked by U.S. travel agents.

APPENDIX

MARKET ANALYSIS 3

AIR TRAFFIC MARKET SPLIT - VANCOUVER/SEATTLE GATEWAYS
BASE CASE

	VANCOUVER WINTER	VANCOUVER SUMMER	SEATTLE WINTER	
Canadian Market				
Eastern Canada	4,024	1,180		
Central Canada	435	158		
Alberta	618	288		
B.C.	1,010	928		
	6,087	2,554		
U.S. Market				
Eastern U.S.	244	413	732	(1)
Southwest U.S.	1,081	478	1,081	(2)
Northwest U.S. (except Ore/Wash)	-	41	106	(3)
Oregon	-	109	404	(3)
Washington		50	3,980	(3)
	1,325	1,091	6,303	
Other				
Foreign	277	276	276	(4)
Unknown	156	281	156	(5)
	433	557	432	
	7,845	4,202	6,735	

(1) assumes 75% of Eastern U.S. traffic travels on U.S. air carriers to connect at Seattle.
(2) assumes 50% of Southwest U.S. traffic travels on U.S. carriers to connect at Seattle.
(3) all Northwest U.S. traffic connects or boards at Seattle.
(4) assumes 50% of all foreign traffic connects at Seattle.
(5) assumes 50% of all unknown traffic connects or boards at Seattle.

APPENDIX

MARKET ANALYSIS 4

AIR TRAFFIC ESTIMATE - BASE YEAR CALCULATION
VANCOUVER GATEWAY ONLY
ONE-WAY PASSENGERS

	AIR TRAVEL MARKET SHARE[1]	WINTER	SUMMER	TOTAL
Eastern Canada	100%	4,024	1,108	5,132
Central Canada	100	435	158	593
Alberta	50	618	288	906
B.C. (local and non-Vancouver)	5	1,010	928	1,938
		6,087	2,482	8,569
Eastern U.S.	100	976	413	1,389
Southwest U.S.	100	2,162	478	2,640
Northwest (exclude Ore/Wash)	50[2]	53	20	73
Oregon	25[2]	126	36	162
Washington	2[2]	318	81	399
		3,635	1,028	4,663
Foreign	100	554	276	830
Unknown	25[2]	106	140	246
		660	416	1,076
		10,382	3,783	14,165

(1) assumed to be connecting air passengers except local Pemberton/Whistler boardings.

(2) assumed that without Seattle gateway, only those passengers who fly into Vancouver from Northwest States will be connecting traffic. Others will elect to use an automobile for entire trip to Whistler.

APPENDIX

MARKET ANALYSIS 5

FORECAST ASSUMPTIONS

1. An additional 200 rooms (4 developments) will be added to the existing 660 base over the next five years.
2. Delta Mountain Inn will add 160 rooms as originally planned.
3. Conference Centre to accommodate 2,000 persons to open in May, 1985 and will be agressively marketed.
4. International tennis centre is established.
5. Downhill Ski Cup held bi-annually as well as other major alpine and cross-country tournaments.
6. Whistler Mountain realigns the gondola and adds additional capacity.
7. Blackcomb adds additional capacity.
8. One, or both, mountains open in the summer.
9. Expo '86 has a stimulating effect on both winter and summer tourism.
10. Weather conditions are favourable for skiing throughout the winter and for summer recreational activities.
11. Whistler Resort Association of skier day projection to 1988/89 meets its target.
12. Air package fare discounts will be available and agressively marketed to encourage interline traffic.
13. More distant markets will experience relatively faster growth rates with increased air access than with closer markets which can drive to Whistler.
14. Whistler resort area becomes a world class, year-round destination resort in the late 1980's.

APPENDIX

MARKET ANALYSIS 6

PROJECTION OF SKIER DAYS

	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
BLACKCOMB	270,000	292,000	312,000				451,000
WHISTLER	427,000	438,000	470,000				600,000
DAY SKIERS	542,000	565,000	595,000	623,000	654,000	686,000	721,000
GROWTH RATE		5%	5%	5%	5%	5%	5%
OVERNIGHT SKIERS	167,000	165,000	189,000	218,000	250,000	287,000	330,000
GROWTH RATE			15%	15%	15%	15%	15%
TOTAL SKIERS	707,000	730,000	782,000	841,000	904,000	973,000	1,051,000
GROWTH RATE		3%	7%	8%	8%	8%	8%

SOURCE: WHISTLER RESORT ASSOCIATION

APPENDIX

MARKET ANALYSIS 7

AIR PASSENGER FORECAST
ONE-WAY PASSENGERS

VANCOUVER/SEATTLE GATEWAYS

VANCOUVER Winter	Base Year	1984/85	1985/86	1986/87	1987/88	1988/89
Eastern Canada	4,024	4,829	6,036	7,545	9,431	11,318
Central Canada	435	500	560	672	773	890
Alberta	618	680	782	899	989	1,088
B.C.	1,010	1,040	1,092	1,147	1,204	1,204
Eastern U.S.	244	305	397	515	670	838
Southwest U.S.	1,081	1,297	1,621	2,026	2,533	3,039
Northwest U.S.						
Oregon						
Washington						
Foreign	277	360	468	632	822	1,068
Unknown	156	187	234	292	365	439
	7,845	9,198	11,190	13,728	16,787	19,920

APPENDIX

MARKET ANALYSIS 7

AIR PASSENGER FORECAST
VANCOUVER/SEATTLE GATEWAYS (cont'd)

VANCOUVER Summer	Base Year	1984/85	1985/86	1986/87	1987/88	1988/89
Eastern Canada	1,108	1,330	1,728	2,160	2,700	3,240
Central Canada	158	190	246	320	400	500
Alberta	288	311	373	429	472	519
B.C.	928	956	1,051	1,104	1,159	1,217
Eastern U.S.	413	516	697	906	1,087	1,359
Southwest U.S.	478	598	807	1,049	1,310	1,638
Northwest U.S.	41	47	59	71	85	102
Oregon	109	118	135	149	164	180
Washington	50	52	58	60	64	67
Foreign	276	345	466	582	728	873
Unknown	281	309	371	408	449	494
	4,202	4,772	5,991	7,238	8,618	10,189

APPENDIX

MARKET ANALYSIS 7

AIR PASSENGER FORECAST
VANCOUVER/SEATTLE GATEWAYS (cont'd)

SEATTLE Winter	Base Year	1984/85	1985/86	1986/87	1987/88	1988/89
Eastern U.S.	732	878	1,142	1,484	1,855	2,320
Southwest U.S.	1,081	1,351	1,756	2,195	2,744	3,293
Northwest U.S.	106	127	159	191	229	275
Oregon	404	444	511	562	618	670
Washington	3,980	4,179	4,597	5,056	5,309	5,575
Foreign	276	345	465	582	728	910
Unknown	156	171	197	217	239	262
	6,735	7,495	8,827	10,287	11,722	13,305
TOTALS						
Winter						
Vancouver	7,845	9,198	11,190	13,728	16,787	19,920
Seattle	6,735	7,495	8,827	10,287	11,722	13,305
	14,580	16,693	20,017	24,015	28,509	33,225
Summer						
Vancouver	4,202	4,772	5,991	7,238	8,618	10,189
	18,782	21,465	26,008	31,253	37,127	43,414

APPENDIX

MARKET ANALYSIS 8

AIR PASSENGER FORECAST
ONE-WAY PASSENGERS
VANCOUVER GATEWAY ONLY

WINTER	Base Year	1984/85	1985/86	1986/87	1987/88	1988/89
Eastern Canada	4,024	4,829	6,036	7,545	9,431	11,318
Central Canada	435	500	560	672	773	890
Alberta	618	680	782	899	989	1,088
B.C.	1,010	1,040	1,092	1,147	1,204	1,240
Eastern U.S.	976	1,220	1,588	2,060	2,680	3,352
Southwest U.S.	2,162	2,594	3,242	4,052	5,066	6,078
Northwest U.S.	53	63	79	95	114	136
Oregon	126	138	159	175	192	207
Washington	318	334	367	404	424	445
Foreign	554	720	936	1,264	1,644	2,136
Unknown	106	127	159	199	249	299
	10,382	12,245	15,000	18,512	22,766	27,189

APPENDIX

MARKET ANALYSIS 8

AIR PASSENGER FORECAST
VANCOUVER GATEWAY ONLY (cont'd)

SUMMER	Base Year	1984/85	1985/86	1986/87	1987/88	1988/89
Eastern Canada	1,108	1,330	1,728	2,160	2,700	3,240
Central Canada	158	190	246	320	400	500
Alberta	288	311	373	429	472	519
B. C.	928	956	1,051	1,104	1,159	1,217
Eastern U.S.	413	516	697	906	1,087	1,359
Southwest U.S.	478	598	807	1,049	1,310	1,638
Northwest U.S.	20	24	30	35	42	51
Oregon	36	39	45	50	55	60
Washington	81	82	90	93	99	104
Foreign	276	345	466	482	728	873
Unknown	140	154	185	203	223	245
	3,783	4,545	5,718	6,931	8,275	9,806
TOTALS						
Winter	10,382	12,245	15,000	18,512	22,766	27,189
Summer	3,783	4,545	5,718	6,931	8,275	9,806
	14,165	16,790	20,718	25,443	31,041	36,995

PROPOSAL FOR MLS/STOL

APPROACH AND MISSED APPROACH PROCEDURE

Pemberton, BC

The de Havilland Aircraft of Canada, Ltd.
Downsview, Ontario
M3K 1Y5

R. Keith Williamson
Supervisor, Special Projects

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Introduction

At the request of Air BC, de Havilland Aircraft of Canada has studied the feasibility of establishing an IFR procedure at Pemberton Airport, BC. The airport is located some 68 nautical air miles north-northwest of Vancouver International Airport and about 19 highway miles from the base of Whistler Mountain Ski Resort. The area is presently served from the south by a paved highway which during the winter months can become treacherous and impassable. The development of an all-weather scheduled service into Pemberton Airport would greatly enhance accessibility to the Whistler Ski Resort area.

The mountain terrain within the immediate vicinity of the airport presents some limitations as to the nature of instrument approach procedures applicable to Pemberton. A conventional Instrument Flight Rule (IFR) procedure is not possible due to the inherent shallow approach and missed approach obstacle clearance planes associated with a conventional approach. However, by utilizing Short Take-off and Landing approach criteria with its steep approach and missed approach gradients, the mountainous terrain becomes less of a problem.

Conventional precision approach landing aids, Instrument Landing Systems (ILS), are limited as to their capabilities in mountainous terrain such as Pemberton. Signal quality deteriorates because of the high terrain and extreme weather conditions. The ILS is capable of defining only a shallow 3° glide path and requires a good deal of site preparation.

The Microwave Landing System (MLS) requires little site preparation and signal quality is unaffected by high terrain or heavy snowfalls. The MLS elevation (glideslope) antenna can define a flight path of up to 9.5° and provides the navigational foundation for a precision track STOL approach.

The procedure proposed for Pemberton is based on the USA FAA criteria for MLS/STOL procedure (order 8260.30, 11/2/77). This criteria takes into account the special performance capabilities of STOL-type aircraft and enhances the application of both STOL and MLS in areas where high terrain limits the application of conventional approach procedures.

The approach track and missed approach track follow the Lillooet River Valley. As a result, the final approach is offset to the runway by 54°. This limits the approach to circling minima of 500 feet and 2 miles visibility. There have been three turns designed into the missed approach procedure. Navigational facilities have been sited to allow for the maximum amount of accuracy throughout the missed approach segment.

A 7.5° glideslope has been used on the final approach. The missed approach clearance plane gradient is 16:1 (as opposed to 40:1 for conventional approaches) based on the criteria set out in 8260.30. All turns incorporate a 1 n.m. radius for the aircraft track and a 2 n.m. radius for the outer edge of the protected turning area. A secondary obstacle clearance area has been added to both precision approach turning areas within the missed approach segment.

MLS/STOL Runway 06 Procedure

Initial Approach

Once established on V321, heading 351°M, the aircraft will intercept the Pemberton MLS (MPEM) front course azimuth at the initial approach point, 7.5 DME from the azimuth. The aircraft will then track outbound on the azimuth on a heading of 297.5° and may begin its descent to the procedure turn altitude of 9,800 feet.

Intermediate Approach

While tracking outbound at 9,800 feet, the aircraft will intercept the glideslope 12.5 DME from the azimuth at the final approach point. Beyond this point, the aircraft will begin a right-hand procedure turn and re-intercept the azimuth on an inbound heading of 117.5°.

Final Approach

Once the aircraft is established on the inbound course, it will intercept the glideslope at 12.5 DME and begin a 7.5° descent to the Missed Approach Point (MAP). From the start of the descent at 9,800 feet, it should be approximately 6 min., 40 sec. to the Missed Approach Point, assuming a 95-kt. final approach speed. The aircraft should be at 4,200 feet ASL (3,400 feet AGL) as it passes through the initial approach point 7.5 DME from the azimuth. From the initial approach point, the time to the MAP will be about 3 min., 50 sec.

Landing

The missed approach is at 1,220 feet ASL (500 feet AGL), 1.8 DME from the azimuth, and about 1.9 n.m. from the end of runway 06. The procedure is offset by 54° from the runway heading. Once the MAP is reached, a left turn must be initiated in order to line up with the centerline of runway 06. If the aircraft describes a 1 n.m. radius turn onto the final approach to runway 06, the track distance from the MAP to the threshold will be 2.1 n.m.

Missed Approach Procedure

If visual contact with the runway environment is not achieved at the Missed Approach Point, an immediate left climbing turn to 10,000 feet will be initiated. The aircraft will intercept and track inbound to the MPEM 067° back course azimuth.

At 4.5 DME from the front course azimuth, the aircraft must perform an immediate right turn to the heading of 104.5° and track inbound to the PEM NDB (located 7.9 n.m. from the second Missed Approach Turning Point). Then an immediate right turn over the PEM NDB and track outbound on a heading of 160.5°. Continue the climb to 10,000 feet, then direct GARRE intersection on V347 off the Vancouver VOR and hold until further cleared by ATC.

Navigational Infrastructure

The high terrain within the immediate vicinity of Pemberton Airport have limited the design options of the Pemberton procedure. In order to achieve the best possible weather minima, an offset procedure with circling minima to the airport has been proposed. The missed approach procedure incorporates three separate turns in order to provide the required terrain clearance. If we had used conventional precision approach aids (i.e. ILS), this approach would not have been possible. However, the proposed use of MLS equipment in the aircraft and on the ground provides the basis for a smooth and accurate procedure with minimal workload for the flight deck. Certain ground installations have been duplicated in order to provide uninterrupted track guidance throughout the entire approach and missed approach procedure.

The DME will be colocated with the MLS azimuth, as indicated on the approach diagram. It will be provided with a dual electronics installation. The back-up system will automatically cut in if the primary system fails.

The MLS azimuth and elevation units will be located approximately 8,000 and 2,000 feet respectively from the missed approach point (as shown on approach diagram). The azimuth will have a 3° beam width and a scan of $\pm$ 20°. The elevation will have a 2° beam width and will scan from 0° to 9.5°. The approach track will be defined along the 00° azimuth radial and 7.5° elevation radial. Both systems are self-monitoring

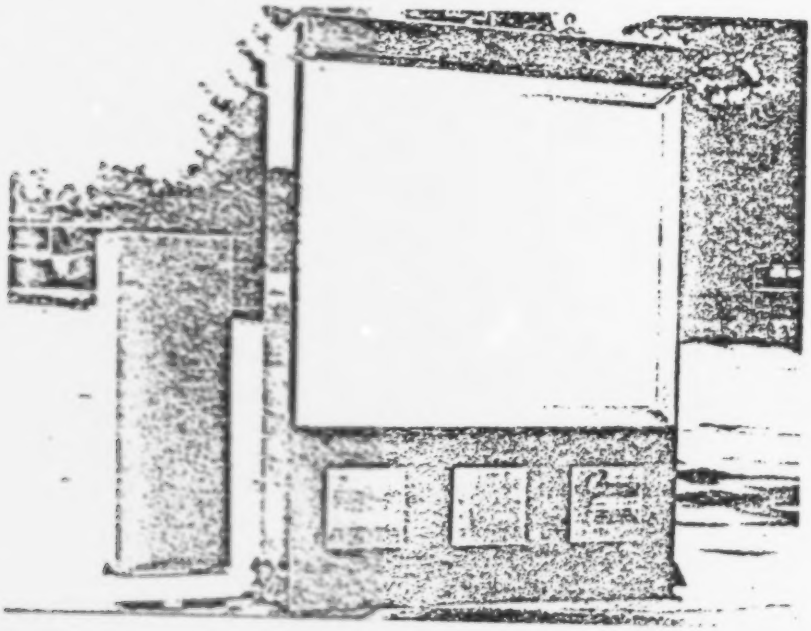
and will be automatically shut down, if the signal propagation falls outside of acceptable limits. If the Dash 7 aircraft loses the MLS signal while on the approach, a missed approach must be initiated by continuing along the final approach heading and intercepting the back course azimuth, as per the quoted missed approach instructions.

The back course azimuth is located approximately 7,000 feet from the second turning point along the missed approach track. It will have a beam width of 1.5° and a ± 10° scan. It will be a dual electronic installation with one azimuth antenna facing west towards the missed approach point. Unlike a normal back azimuth configuration, the aircraft will fly towards the installation rather than away from it. This will allow for precision approach guidance towards the second missed approach turn and greater accuracy through the missed approach procedure. The back course AZ signal will be reversed on board the aircraft so the pilot will receive the normal "fly to the needle" information. No frequency change will be required. As soon as the receiver picks up the back course azimuth signal, the aircraft will track to the 00° back course AZ radial along the missed approach track. Confirmation of back course signal reception will be identified by a back course signal identification light in the cockpit.

The back AZ will be continually monitored. If signal propagation falls below the standard signal format requirements, the primary system will shut down and the secondary system will cut in automatically. Loss of signal coverage within the cockpit is negligible.

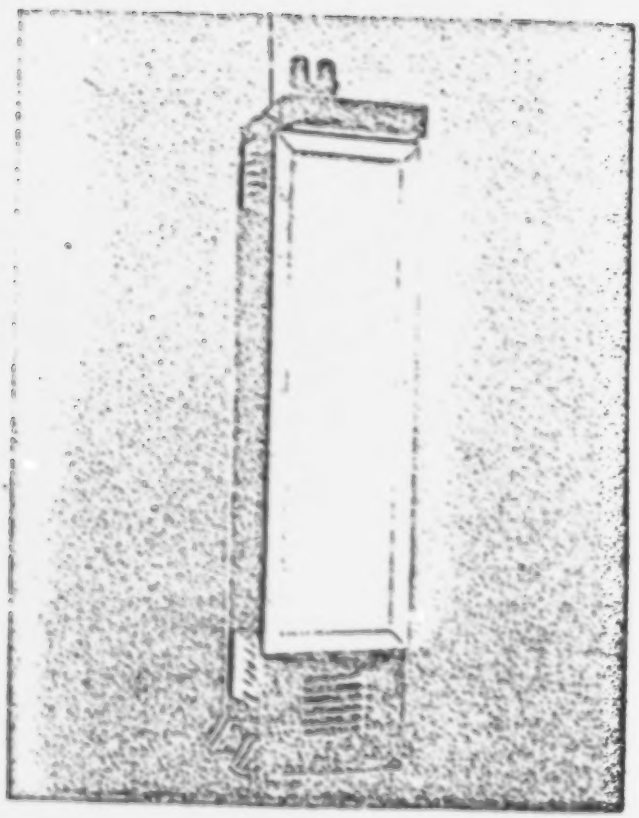
A dual NDB will be located on the eastern shore of Lillooet Lake, 7.9 nautical miles from the second missed approach turn (6.5 miles from the back AZ). This will be a dual electronics installation. If the primary system fails, the secondary system cuts in automatically. As in the case for the dual back AZ installation signal, loss of the NDB signal will be negligible within the cockpit. The NDB will provide positive track guidance to the third and final turning point along the missed approach track.

The MLS receive system on board the aircraft will be a dual installation to provide the proper redundancy required for a full IFR procedure such as this. It will be coupled with the flight director and autopilot. This allows the approach to be flown in an automated mode allowing the crew more time to monitor aircraft systems and the general progress of the approach procedure.



A.

Fig. A: MLS Azimuth Antenna



B.

Fig. B: MLS Elevation Antenna

Approach Lighting Infrastructure

In order for the airport to be fully operational under both day and night IFR conditions, certain points must be considered with regard to approach and runway lighting. It is proposed that a rotating beacon be installed on top of the terminal building and be operational during IFR and/or night conditions. A lighted wind indicator will be installed midfield on the north side of the runway.

It is essential to give the aircraft every advantage of achieving visual contact with the runway environment during weather conditions approaching the IFR limits of the procedure (500 feet/two miles). The MLS approach is offset to the runway centerline by some 54°. That, coupled with the relatively low altitude of the aircraft at the MAP and the very high terrain in close proximity to the visual approach track, may provide the potential for the pilot to become visually disoriented as to the location of the runway threshold. For this reason, it has been proposed that a rather lengthy approach lighting system be established to provide the aircraft with some guidance onto the extended centerline of the runway some 3,000 feet from the threshold. Starting immediately past the MLS elevation installation, an omni-directional approach lighting system would define a one nautical mile radius arc or turn onto the final approach path to runway 06. The lights would be placed at 1,000-foot intervals for a distance of 5,000 feet. They would lead into a standard center row, low-intensity system continuing to the threshold. The center row system would

be 3,000 feet in length with 200-foot spacing between lights. In order to define the visual approach track during conditions of poor visibility, it is proposed that sequenced flashing condenser discharge lights be installed throughout the entire approach lighting system. The sequential system would incorporate runway identification lights (flashing condenser discharge lights) at the threshold of runway 06. Runway identification lights would be placed at the threshold of runway 24 for circling procedures to this runway. The runway edge lighting would be high intensity with five variable settings.

Due to the close proximity of high terrain throughout the entire approach procedure, it may be advantageous to mark certain points of high terrain with appropriate obstruction lighting (i.e. white flashing strobes). Towers or other man-made obstructions within close proximity to the airport may be marked in the same manner.

Conclusion

The proposed MLS/STOL approach is a unique solution for IFR access to Pemberton Airport made possible by today's STOL technology. The Pemberton approach is designed to performance characteristics and technological standards beyond those which are common at most of today's airports. From a conventional standards point of view, the Pemberton MLS/STOL approach is complicated and beyond the capabilities of a Conventional Take-off and Landing (CTOL) aircraft. However, for STOL aircraft such as the Dash 7 with the navigational avionics packages available to us today, this procedure becomes as normal and standard an operation as any CTOL aircraft would experience landing in IFR conditions at Vancouver International.

APPENDIX

TECHNICAL ANALYSIS 2

AIRCRAFT FLYING HOURS
VANCOUVER/SEATTLE GATEWAYS

Vancouver-Pemberton	90 nm	26 minutes	30 minutes
Seattle-Pemberton	192 nm	54 minutes	60 minutes
Winter - 150 operating days			
Vancouver-Pemberton @ 3 hours/day			450 hours
3 return flights/day			
Seattle-Pemberton @ 4 hours/day			600 hours
2 return flights/day			1050 hours
Summer - 215 operating days			
Vancouver-Pemberton @ 1 hour/day			215 hours
1 return flight/day			
			1265 hours

Vancouver Gateway Only	
Winter - 150 operating days	
Vancouver-Pemberton @ 4 hours/day	600 hours
4 return flights/day	
Summer - 215 operating days	
Vancouver-Pemberton @ 1 hour/day	215 hours
1 return flight/day	
	815 hours

APPENDIX

TECHNICAL ANALYSIS 3

PASSENGER LOAD FACTOR
VANCOUVER/SEATTLE GATEWAYS

Winter

Vancouver - 3 round trips/day @ 150 days
45,000 available seats (two-way)

	1984/85	1985/86	1986/87	1987/88	1988/89
Passengers	18,396	22,380	27,456	33,574	39,840
Load Factor	40.9	49.7	61.0	74.6	88.5

Seattle - 2 round trips/day @ 150 days
30,000 available seats (two-way)

	1984/85	1985/86	1986/87	1987/88	1988/89
Passengers	14,990	17,654	20,574	23,444	26,610
Load Factor	49.9	58.8	68.5	78.1	88.7

Summer

Vancouver - 1 round trip/day @ 215 days
21,500 available seats (two-way)

	1984/85	1985/86	1986/87	1987/88	1988/89
Passengers	9,744	11,982	14,476	17,236	20,378
Load Factor	44.4	55.7	67.3	80.2	94.7

TOTAL
96,500 available seats

	1984/85	1985/86	1986/87	1987/88	1988/89
Passengers	42,930	52,016	62,506	74,254	86,828
Load Factor	44.5	53.9	64.8	76.9	89.9

NOTE: Beyond 1986/87, additional flights will have to be added to serve the markets since load factors beyond 60% are not realistically sustainable.

APPENDIX

TECHNICAL ANALYSIS 4

PASSENGER LOAD FACTOR
VANCOUVER GATEWAY ONLY

Winter

Vancouver - 4 round trips/day @ 150 days
60,000 available seats (two-way)

	1984/85	1985/86	1986/87	1987/88	1988/89
Passengers	24,490	30,000	37,024	45,532	54,378
Load Factor	40.8	50.0	61.7	75.9	90.6

Summer

Vancouver - 1 round trip/day @ 215 days
21,500 available seats (two-way)

	1984/85	1985/86	1986/87	1987/88	1988/89
Passengers	9,090	11,436	13,862	16,550	19,612
Load Factor	42.3	53.2	64.5	76.9	91.2

TOTAL

81,500 available seats

	1984/85	1985/86	1986/87	1987/88	1988/89
Passenger	33,580	41,436	50,886	62,082	73,990
Load Factor	41.2	50.8	62.4	76.2	90.7

NOTE: Beyond 1986/87, additional flights will have to be added to serve the markets since load factors beyond 60% are not realistically sustainable.

APPENDIX

PROJECT BENEFITS 1

AirBC REVENUE ($)
VANCOUVER/SEATTLE GATEWAYS

Winter	1984/85	1985/86	1986/87	1987/88	1988/89
Vancouver					
Passengers	922,559	1,122,357	1,376,918	1,687,736	1,997,976
Freight	20,500	21,000	21,500	22,000	22,500
	943,059	1,143,357	1,398,418	1,705,736	2,020,476
Seattle					
Passengers	1,083,028	1,275,501	1,486,471	1,693,829	1,922,572
Freight	5,000	5,500	6,000	6,500	7,000
	1,088,028	1,281,001	1,492,471	1,700,329	1,929,572
Summer					
Vancouver					
Passenger	488,662	600,897	725,971	864,384	1,021,957
Freight	29,500	30,000	30,500	31,000	31,500
	518,162	630,897	756,471	895,384	1,053,457
TOTAL					
Passenger	2,494,249	2,998,755	3,589,360	4,241,949	4,942,505
Freight	55,000	56,500	58,000	59,500	61,000
	2,549,249	3,055,255	3,647,360	4,301,499	5,003,505

BASED ON:

Passenger - Vancouver/Pemberton one-way fare of $59.00 effective fare yield 85%, therefore $50.15
Seattle/Pemberton one-way fare of $85.00 effective fare yield 85%, therefore $72.25

Freight - Vancouver/Seattle-Pemberton 25¢ per pound minimum shipment of $18.00

APPENDIX

PROJECT BENEFITS 2

AirBC REVENUE ($)
VANCOUVER GATEWAY ONLY

	1984/85	1985/86	1986/87	1987/88	1988/89
Winter					
VANCOUVER					
Passengers	1,228,173	1,504,500	1,856,754	2,283,430	2,727,057
Freight	20,500	21,000	21,500	22,000	22,500
	1,248,673	1,525,500	1,878,254	2,305,430	2,744,557
Summer					
VANCOUVER					
Passengers	455,863	535,515	695,179	829,982	983,542
Freight	29,500	30,000	30,500	31,000	31,500
	485,363	565,515	725,679	860,982	1,015,042
TOTAL					
Passengers	1,734,036	2,091,015	2,573,933	3,166,412	3,759,599
Freight	50,000	51,000	52,000	53,000	54,000
	1,784,036	2,142,015	2,625,933	3,219,412	3,813,599

Based on:

Passenger - Vancouver/Pemberton one-way fare of $59.00
effective yield 85%, therefore $50.15

Freight - Vancouver/Pemberton 24¢/pound
minimum shipment of $18.00

APPENDIX

PROJECT BENEFITS 3

AirBC REVENUE/COST ($)
VANCOUVER/SEATTLE GATEWAYS

	1984/85	1985/86	1986/87
Winter			
Vancouver			
Revenue	943,059	1,143,357	1,398,418
Costs	810,000	810,000	810,000
Gross	133,059	333,357	588,418
Seattle			
Revenue	1,088,028	1,281,001	1,492,471
Costs	1,080,000	1,080,000	1,080,000
Gross	8,028	201,001	412,471
Summer			
Vancouver			
Revenue	518,162	630,897	756,471
Costs	387,000	387,000	387,000
Gross	137,162	243,897	369,471
TOTAL			
Revenue	2,549,249	3,055,255	3,647,360
Costs	2,277,000	2,277,000	2,277,000
Gross	272,249	778,255	1,370,360

Assumes fully allocated cost of Dash 7 to be $1,800 per flying hour.

APPENDIX

PROJECT BENEFITS 4

AirBC REVENUE/COST ($)
VANCOUVER GATEWAY ONLY

	1984/85	1985/86	1986/87
WINTER			
VANCOUVER			
Revenue	1,248,673	1,525,500	1,878,254
Costs	1,086,000	1,080,000	1,080,000
Gross	168,673	445,500	798,254
SUMMER			
VANCOUVER			
Revenue	485,363	565,515	695,679
Costs	387,000	387,000	387,000
Gross	98,363	178,515	308,679
TOTAL			
Revenue	1,784,036	2,142,015	2,625,933
Costs	1,467,000	1,467,000	1,467,000
Gross	317,036	675,015	1,158,933

Assume fully allocated cost of DASH 7 to be $1,800 per flying hour.

APPENDIX

PROJECT BENEFITS 5

AIR VISITOR WHISTLER EXPENDITURES - DIRECT $
VANCOUVER/SEATTLE GATEWAYS

	BASE YEAR	1984/85	1985/86	1986/87	1987/88	1988/89
WINTER						
Accommodation	2,332,800	2,670,880	3,202,720	3,842,400	4,561,440	5,316,000
Food	1,458,000	1,669,300	2,001,700	2,401,500	2,850,900	3,322,500
Recreation	874,800	1,001,580	1,201,020	1,440,900	1,710,540	1,993,500
Entertainment	291,600	338,860	400,340	480,300	570,180	664,500
Shopping	291,600	338,860	400,340	480,300	570,180	664,500
Miscellaneous	291,600	338,860	400,340	480,300	570,180	664,500
	5,832,000	6,677,200	8,006,800	9,606,000	11,403,600	13,290,000
Marginal Addition	-	845,200	1,329,600	1,599,200	1,797,600	1,886,400
SUMMER						
Accommodation	252,120	286,320	359,460	434,280	517,080	611,340
Food	210,100	238,600	299,550	361,900	430,900	509,450
Recreation	126,060	143,160	179,730	217,140	258,540	305,670
Entertainment	42,020	47,720	59,910	72,380	86,180	101,890
Shopping	42,020	47,720	59,910	72,380	86,180	101,890
Miscellaneous	42,020	47,720	59,910	72,380	86,180	101,890
	672,320	763,520	958,560	1,158,080	1,378,880	1,630,240
Marginal Addition	-	91,200	195,040	199,520	220,800	251,360

Based on:

Winter $100/day for 4 day average
Summer $ 80/day for 2 day average

See: The British Columbia Skier Survey 1982, Ministry of Tourism and Brief to the ATC Hearings, Canadian Ski Council.

APPENDIX

PROJECT BENEFITS 6

AIR VISITOR WHISTLER EXPENDITURES - INDIRECT $
VANCOUVER/SEATTLE GATEWAYS

	BASE YEAR	1984/85	1985/86	1986/87	1987/88	1988/89
WINTER						
Direct	5,832,000	6,677,200	8,006,900	9,606,000	11,403,600	13,290,000
Indirect	15,688,080	17,961,668	21,538,292	25,840,140	30,675,684	35,750,100
Marginal Addition	-	2,273,588	3,576,624	4,301,848	4,835,544	5,074,416
SUMMER						
Direct	672,320	763,520	958,560	1,158,030	1,378,880	1,630,240
Indirect	1,808,541	2,053,869	2,578,526	3,115,235	3,709,187	4,385,345
Marginal Addition	-	245,328	524,658	536,709	593,952	676,158
TOTAL						
Direct	6,504,320	7,440,720	8,965,360	10,764,080	12,782,480	14,920,240
Indirect	17,496,621	20,015,537	24,116,818	28,955,375	34,384,871	40,135,445
Marginal Addition	-	2,518,916	4,101,282	4,838,557	5,429,496	5,750,574

Indirect Multiplier Based on Input/Output Multiplier of 2.64. See Archer Brian, Tourism Multipliers: The State of the Art, Bangor Occasional Papers in Economics No. 11, University of Wales Press 1977.

APPENDIX

PROJECT BENEFITS 7

AIR VISITOR WHISTLER EXPENDITURES - DIRECT $
VANCOUVER GATEWAY ONLY

	BASE YEAR	1984/85	1985/86	1986/87	1987/88	1988/89
WINTER						
Accommodation	1,663,680	1,959,200	2,400,000	2,961,920	3,642,560	4,350,240
Food	1,039,880	1,224,500	1,500,000	1,851,200	2,276,600	2,718,900
Recreation	811,840	979,600	1,200,000	1,480,960	1,821,280	2,175,120
Entertainment	207,960	244,900	300,000	370,240	455,320	543,780
Shopping	207,960	244,900	300,000	370,240	455,320	543,780
Miscellaneous	207,960	244,900	300,000	370,240	455,320	543,780
	4,159,200	4,898,000	6,000,000	7,404,800	9,106,400	10,875,600
Marginal Addition	-	738,800	1,102,000	1,404,800	1,701,600	1,769,200
SUMMER						
Accommodation	226,980	272,700	343,080	415,860	496,500	588,360
Food	189,150	227,250	285,900	346,550	413,750	490,300
Recreation	113,490	136,350	171,540	207,930	248,250	294,180
Entertainment	37,830	45,450	57,180	69,310	82,750	98,060
Shopping	37,830	45,450	57,180	69,310	82,750	98,060
Miscellaneous	37,830	45,450	57,180	69,310	82,750	98,060
	605,280	727,200	914,880	1,108,960	1,324,000	1,568,960
Marginal Addition	-	121,920	187,680	194,080	215,040	244,960

Based on:

Winter $100/day for 4 day average
Summer $ 80/day for 2 day average

See: The British Columbia Skier Survey 1982. Ministry of Tourism and Brief to the ATC Hearings, Canadian Ski Council.

APPENDIX

PROJECT BENEFITS 8

AIR VISITOR WHISTLER EXPENDITURES - INDIRECT $
VANCOUVER GATEWAY ONLY

	BASE YEAR	1984/85	1985/86	1986/87	1987/88	1988/89
WINTER						
Direct	4,159,200	4,898,000	6,000,000	2,404,800	9,106,400	10,875,000
Indirect	11,188,248	13,175,620	16,140,000	19,918,912	24,496,216	29,255,364
Marginal Addition	-	1,987,372	2,964,380	3,778,912	4,577,304	4,759,148
SUMMER						
Direct	605,280	827,200	914,880	1,108,960	1,324,000	1,568,960
Indirect	1,628,203	1,956,168	2,461,027	2,983,102	3,561,560	4,220,502
Marginal Addition	-	327,965	504,859	522,075	578,458	658,942
TOTAL						
Direct	4,764,480	5,625,200	6,914,800	8,513,760	10,430,400	12,444,560
Indirect	12,816,451	15,131,788	18,601,027	22,902,014	28,057,776	33,475,860
Marginal Addition	-	2,315,337	3,469,239	4,300,987	5,155,762	5,418,090

Indirect Multiplier based on Input/Output Multiplier of 2.64. See Archer Brian, Tourism Multipliers; The State of The Art, Bangor Occasional Papers in Economics No. 11, University of Wales Press, 1977

APPENDIX

PROJECT BENEFITS 9

EMPLOYMENT - WHISTLER
VANCOUVER/SEATTLE GATEWAYS

	BASE YEAR	1984/85	1985/86	1986/87	1987/88	1988/89
Direct (1)						
Winter	123	141	169	202	240	280
Summer	12	16	20	25	28	35
	135	157	189	247	268	315
Marginal Addition	-	22	32	58	21	47
Indirect (2)						
Winter	298	341	409	489	580	678
Summer	29	39	48	60	68	85
	327	380	457	549	684	763
Marginal Addition	-	53	77	92	99	115

(1) Assumes that half of the Whistler expenditures are allocated to wages and salaries, and that one man-year of employment is created for every $23,700 (B.C. average) in wages and salaries.

(2) Assumes an employment multiplier of 2.42. See Archer Brian, Tourism Multipliers: The State of the Art.

APPENDIX

PROJECT BENEFITS 10

EMPLOYMENT - WHISTLER
VANCOUVER GATEWAY ONLY

	BASE YEAR	1984/85	1985/86	1986/87	1987/88	1988/89
Direct (1)						
Winter	87	103	126	156	192	230
Summer	12	16	20	24	28	33
	99	119	146	180	220	263
Marginal Addition	-	20	27	34	40	43
Indirect (2)						
Winter	211	249	305	377	465	556
Summer	29	39	48	58	68	80
	240	288	353	435	533	636
Marginal Addition	-	48	65	82	98	103

(1) Assumes that half of the Whistler expenditures are allocated to wages and salaries, and that one man-year of employment is created for every $23,700 (B.C. average) in wages and salaries.

(2) Assumes an employment multiplier of 2.42. See Archer Brian, Tourism Multipliers: The State of the Art.

APPENDIX

PROJECT BENEFITS 11

EMPLOYMENT INCOME TAX ($)
VANCOUVER/SEATTLE GATEWAYS

PEMBERTON DIRECT EMPLOYMENT

Provincial Tax	12,815
Federal Tax	27,261
	40,076

WHISTLER DIRECT EMPLOYMENT

	BASE YEAR	1984/85	1985/86	1986/87	1987/88	1988/89
Provincial Tax	178,880	204,647	246,547	296,012	751,518	410,307
Federal Tax	380,500	435,340	524,473	629,699	747,775	872,834
	559,383	639,987	771,020	925,711	1,099,293	1,283,141

PEMBERTON INDIRECT EMPLOYMENT

Provincial Tax	23,067
Federal Tax	49.070
	72,137

WHISTLER INDIRECT EMPLOYMENT

	BASE YEAR	1984/85	1985/86	1986/87	1987/88	1988/89
Provincial Tax	481,157	550,427	663,212	796,272	945,582	1,103,725
Federal Tax	1,023,552	1,170,909	1,410,834	1,693,889	2,011,515	2,347,923
	1,504,709	1,721,336	2,074,046	2,490,161	2,957,098	3,451,648

Assumes 60% are married with two children, 40% single.
Average wages and salaries $23,700.
Provincial tax rate .055%
Federal tax rate .117%

Source: Currie Cooper & Lybrand

APPENDIX

PROJECT BENEFITS 12

EMPLOYMENT INCOME TAX ($)
VANCOUVER GATEWAY ONLY

PEMBERTON DIRECT EMPLOYMENT

Provincial Tax	11,440
Federal Tax	24,336
	35,776

WHISTLER DIRECT EMPLOYMENT

	BASE YEAR	1984/85	1985/86	1986/87	1987/88	1988/89
Provincial Tax	131,023	154,693	189,607	234,128	296,836	342,225
Federal Tax	278,722	329,074	404,516	498,055	610,178	728,006
	409,745	483,767	594,123	732,183	897,014	1,070,231

PEMBERTON INDIRECT EMPLOYMENT

Provincial Tax	20,592
Federal Tax	43,805
	64,397

WHISTLER INDIRECT EMPLOYMENT

	BASE YEAR	1984/85	1985/86	1986/87	1987/88	1988/89
Provincial Tax	352,452	416,124	511,528	629,805	771,589	920,586
Federal Tax	749,762	885,210	1,088,160	1,339,768	1,641,380	1,958,338
	1,102,214	1,301,339	1,599,688	1,696,573	2,412,969	2,878,924

Assumes 60% are married with two children, 40% single.
Average wages and salaries $23,700.
Provincial tax rate .055%
Federal tax rate .117%

Source: Currie Cooper & Lybrand

APPENDIX

PROJECT BENEFITS 13

PROVINCIAL SALES TAX ON WHISTLER EXPENDITURES ($)
VANCOUVER/SEATTLE GATEWAYS

	BASE YEAR	1984/85	1985/86	1986/87	1987/88	1988/89
Direct						
Winter	408,240	467,404	560,476	672,420	798,252	930,300
Summer	47,062	53,446	67,099	81,065	96,522	114,167
Total	455,302	520,850	627,575	753,485	894,774	1,044,467
Indirect						
Winter	1,098,166	1,257,317	1,507,680	1,808,810	2,147,298	2,502,507
Summer	126,598	143,770	180,518	210,066	259,643	306,974
Total	1,224,764	1,401,087	1,688,198	2,018,876	2,406,941	2,809,481

Assumes that all expenditures are subject to 7% Provincial Sales Tax.

APPENDIX

PROJECT BENEFITS 14

PROVINCIAL SALES TAX ON WHISTLER EXPENDITURES ($)
VANCOUVER GATEWAY ONLY

	BASE YEAR	1984/85	1985/86	1986/87	1987/88	1988/89
Direct						
Winter	291,144	342,860	420,000	518,336	637,448	761,292
Summer	42,370	50,904	64,042	77,627	92,680	109,827
Total	333,514	393,764	484,042	595,963	730,128	871,119
Indirect						
Winter	783,177	922,293	1,129,800	1,394,323	1,714,735	2,047,875
Summer	113,974	136,932	172,272	208,817	249,309	295,435
Total	897,151	1,059,225	1,302,072	1,603,140	1,964,044	2,343,310

Assumes that all expenditures are subject to 7% Provincial Saels Tax.

APPENDIX

PROJECT BENEFITS 15

	AVIATION FUEL TAX ($)	
	Vancouver/Seattle Gateways	Vancouver Gateway Only
Winter		
Vancouver - Pemberton	460,350 litres	613,800 litres
Seattle - Pemberton	613,800 litres	
Summer		
Vancouver - Pemberton	219,945 litres	219,945 litres
Provincial Tax		
Winter - Vancouver	23,248	30,997
- Seattle	30,997	
Summer - Vancouver	11,107	11,107
	65,352	42,104
Federal Tax		
Winter - Vancouver	14,731	19,642
- Seattle	19,642	
Summer - Vancouver	7,038	7,038
	41,411	26,680
TOTAL	106,763	68,784

Assumptions: Dash 7 consumes 1023 litres/hour of JET B fuel.

Provincial Tax	.0505/litre
Federal Tax 9% of selling price	.0320/litre
	.0825/litre

All fuel purchased in Canada.

APPENDIX

PROJECT BENEFITS 16

AIR TRANSPORTATION TAX ($)
VANCOUVER/SEATTLE GATEWAYS

	1984/85	1985/86	1986/87	1987/88	1988/89
Vancouver					
Winter	36,902	44,894	55,077	67,349	79,919
Summer	19,546	24,036	29,039	34,575	40,878
	56,448	68,920	84,116	101,924	120,797
Pemberton					
Winter	80,224	95,914	114,536	135,102	156,822
Summer	19,546	24,036	29,039	34,575	40,878
	99,760	119,950	143,575	169,677	197,700
Seattle					
Winter	43,321	51,020	59,459	67,753	76,903
Total					
Canadian Portion	156,218	188,880	227,691	271,601	318,497

Assumptions:

- does not include air transportation tax on connecting air carriers
- U.S. boarding tax collected and retained by FAA
- Air Transportation tax of 8% applies to net fare revenue

APPENDIX

PROJECT BENEFITS 17

AIR TRANSPORTATION TAX ($)
VANCOUVER GATEWAY ONLY

	1984/85	1985/86	1986/87	1987/88	1988/89
Vancouver					
Winter	49,126	60,180	74,270	91,337	109,081
Summer	18,235	22,940	27,807	33,199	39,340
	67,361	83,120	102,077	124,536	148,421
Pemberton					
Winter	49,126	60,180	74,270	91,337	109,081
Summer	18,235	22,940	27,807	33,199	39,340
	67,361	83,120	102,077	124,536	148,421
Total	134,722	166,240	204,154	249,072	296,842

Assumption: Does not include air transportation on connecting air carriers.

Air Transportation Tax of 8% applies to net fare revenue.

APPENDIX

PROJECT BENEFITS 18

AIRCRAFT LANDING FEES ($)

	Vancouver/Seattle Gateways		Vancouver Gateway Only	
Winter				
Vancouver	450 landings	11,700	600 landings	15,600
Pemberton	750 landings	19,500	600 landings	15,600
Seattle	300 landings	7,800		
		39,000		31,200
Summer				
Vancouver	215 landings	5,590	215 landings	5,590
Pemberton	215 landings	5,590	215 landings	5,590
		11,180		11,180
Total				
Vancouver		17,290		21,190
Pemberton		25,090		21,190
Seattle		7,800		
		50,180		42,380

Assumption: $26.00 per landing for the DASH 7 collected by the local airport authority.